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WIRELESS TELEGRAPHY.

At last Mr. Marconi is in this country and we shall now have a good chance to find out just how far wireless telegraphy can transmit a message. It is now a matter of official record that he has sent messages at sea over a distance of eighty miles, and he has intimated to ourselves since his arrival that such a distance, remarkable as it is, by no means sets a limit to the powers of his latest apparatus. In this country, experimenters have been pottering around and sending signals a distance of perhaps three or four miles, and if they have done any better, it is certain no authentic record has been made of it or can be found. For this reason alone, if for no other, we are glad to welcome the talented young Anglo-Italian and to assure him that nowhere will his work be better appreciated than in this country of magnificent distances.

THE INTERNAL ACTIONS AND REACTIONS OF THE INDUCTION MOTOR.

It is one of the paradoxes of electrical engineering that the electrodynamic machine, which is structurally one of the most simple in character, should be the seat of magnetic phenomena most difficult to fully comprehend and analyze. There are several radically different points of view from which the performance of the induction motor may be discussed, and from any one of these the main qualities of the machine may be discovered. The field of the machine may be considered as rotary in character or as simply one alternating field reacting upon another out of phase with and angularly displaced from it—two quite contradictory conceptions but leading to the same general results.

When the attempt is made to predetermine the effect upon the performance of a motor of the almost infinite number of possible variations in its design, the simple conception of the two alternating fields or the one rotary field is immediately complicated by magnetic leakage, harmonics of the impressed wave and of that foe of all simplicity in electrical mathematics—the varying qualities of iron. In their train comes the complication of the field of force around the teeth of the stator and rotor of the motor and crossing the air gap between them, the lines of which appear in mathematical calculation almost an unravelable snarl dependent as they are upon so many factors—the number of teeth per pole, the number of phases, length and breadth of the teeth, the width of the air gap, the resistance of primary and secondary, etc. It is on this account that the study of this motor becomes so complex. In our columns studies from different points of view have been from time to time presented, and on another page will be found an extended analysis of the interaction of the currents and magnetizations thereby produced, which has the advantage of simplicity though obtained at possibly a necessary sacrifice of brevity.

The induction motor at its best is, in spite of its simplicity, an expensive machine. The strength of its field cannot be much more than half that customary in direct current and synchronous machinery—otherwise its power factor will be atrocious—and its output per pound of weight is reduced in proportion. Its entire magnetic circuit must be of most expensive material. Its windings must be very finely distributed in a large number of slots and its peripheral speed must be high in order to give room for the required number of slots

per pole and in order to give a reasonable output per pound of weight and dollar of cost. The study given this machine during the last few years by the engineering staffs of a few manufacturers, notably in this country, has done wonders in improving its power factor, overload capacity and starting torque. A complete comprehension and discussion of all the factors involved may be expected to accomplish further results in the same direction.

HANDY METHODS OF VOLTAGE REGULATION.

In water power plants carrying electric railway loads the demand is often so fluctuating that no water wheel governor, no matter how perfect, can maintain an exactly constant speed. Some quick acting, automatic means must be adopted in such plants to maintain constant voltage with a wide range of speed variations. One ingenious means of accomplishing this result is described by Prof. F. W. Springer in an article on another page, describing a water power plant in St. Cloud, Minn.

The normal speed of the generators in this case was increased so that even at a considerably lower speed the fields could be oversaturated enough to maintain voltage. The two coils of the shunt field winding normally connected in series were then connected in parallel so that more current could be passed through them and an automatic voltage regulator was installed. With such a method the fields are of course greatly weakened, while the wheels are running rapidly, but fortunately the load is at such times light, so that commutation is not seriously disturbed. The current wasted in field excitation is practically double that of the same machines as ordinarily connected and run at constant speed, but this loss is as a rule immaterial in water power plants and slight compared with that of the cure often adopted in such cases, viz., the use of an artificial load with automatically controlled switches to maintain the total output constant.

As the automatic voltage regulator in this case serves chiefly to increase the field strength as the speed goes down and vice versa, the compounding being taken care of as usual by series coils, it is obvious that the same result might be accomplished somewhat more directly and promptly with cheaper apparatus by arranging a centrifugal device to operate the field rheostat. This could be made sufficiently heavy so that the friction of the rheostat arm would not materially retard it, and would more promptly accomplish the desired change in the rheostat resistance than would any relay voltage regulator requiring a sequence of operations after the speed falls.

MUNICIPAL OWNERSHIP.

Elsewhere we print an abstract of the proceedings of those sessions of the recent Syracuse Convention of the League of American Municipalities, at which the subject of municipal ownership was discussed. The proceedings were so voluminous that the abstract given, though occupying considerable space, but briefly covers the papers and discussion, which together would fill fully 300 pages of an ordinary octavo volume. It was quite evident from the tone of the meeting that there was practical unanimity on the part of city officials present in favor of the municipal ownership and operation of public utilities. Whether in this position they were personally sincere or only sustaining a political attitude, is immaterial, for the fact remains that they represent an apparently growing sentiment throughout the country in favor of municipal ownership. This sentiment has, in fact, passed into politics and, particularly in the west, has become an article of political faith in the platforms of parties. It is therefore doubtful if arguments based upon theoretical economic considerations will have much effect in checking the movement among the masses, any more than similar economic arguments have had among the same classes an influence for or against protection or any of the other economic questions which have entered the field of politics. Nor in the present state of the situation do we think it advisable to bring forward too prominently the argument as to the increase of political corruption believed to be almost necessarily involved in the adoption of municipal ownership. This argument appears to be particularly irritating, for it not only attacks the motives of those leading the movement, but is apt to be construed by the rank and file as an attack on popular government. At Syracuse the remarks of one of the opponents of municipal ownership which were construed as a reflection on the honesty of its advocates, led to an unpleasant scene; and when the argument was advanced that municipal ownership involved danger from increased political corruption, it was met by the statement that corporations owning and operating private utilities are at present a most potent corrupting influence in American municipalities. In other words, argument on this aspect of the question is apt merely to lead to charges and countercharges that will simply render the situation more acute, and may close to reason ears that might otherwise listen.

In view of the conditions existing in our country—conditions which are due to our popular form of government and consequently permanent in their nature—the advocates of private ownership have a case so strong that it merely needs to be fairly placed in a light that will appeal to the multitude in order to carry conviction. The secret of business success in these days lies in the margin between what comes to those who possess merely average qualities and perseverance, and that which comes to the others who through the possession of unusual qualities or by strenuous effort create the conditions which result in success. If one casts his eyes about him he can see proofs of this on every hand, and most business failures are due to the fact that some can transact business at a profit which others cannot carry on at cost. In the case of municipal ownership, the lack of incentive would alone suppress this margin, and the trammels to which the most competent management would be subjected as to purchases, improvements, labor and other factors, would act as still further handicaps. But this view may be set forth ever so strongly; ethical considerations may be brought forward; the danger may be shown of a step toward a form of socialism involving the suppression of individual effort and, through the loss of incentive, endangering the material advancement of the race; the theory of profits may be discussed, and every economic authority quoted in support of a contention adverse to municipal ownership—but without the slightest effect on the average voter.

In what manner, it will be asked, can the case be presented so that its strength may be apparent to all, and that it may favorably influence those whose ears are not open to reason as ordinarily set forth? The answer, we believe, lies in the proposals made at Syracuse by several of the advocates of private ownership, asking that the management of all public utilities, whether under public or municipal ownership, be required by legislative enactment, to make annual public statements in such form that all of the items entering into cost shall be separated so as to admit of comparisons between plants, the statement also including proper classification of all factors entering into the business. Such a means would permit a community to positively know if a public service was being conducted at an undue profit to private owners, and thus in most cases lead to its regulation, where otherwise merely an adverse suspicion would lead to a movement for municipal ownership. Where the sentiment was strong for municipal ownership notwithstanding the proper character of the existing service, a comparison of the cost, item by item, under the proposed scheme would be available by reference not only to established municipal plants, but also with respect to local conditions influencing cost under the proposed change. In brief, when the question of municipal ownership arose in a community, it would become

not one of theories and politics, but could be kept on the plane of dollars and cents, and thus made to appeal to all. Where corporations are actually guilty of rapacious greed, they would soon be subjected to the proper check, and thus a menace to the industry at large be removed. In some cases, of course, inefficient private management would show results inferior to efficient municipal management, in which case the penalty would probably be loss of franchise, unless, indeed, the publication and comparison of accounts did not lead to such inefficient plants being reorganized by the owners, or purchased for that purpose by another whose attention had been attracted by the published showing.

Such a plan is, of course, no novelty, as it is similar to that carried out by the English Board of Trade, and to a limited extent is in operation in Massachusetts, and, with respect to railways, in New York State. While no action was taken at Syracuse on the suggestions brought before the league in the matter, a step in another direction was taken which might have led to consequences having a favorable bearing on it. We refer to the propostion presented by the National Electric Light Association, offering to pay half the expense of investigating five selected municipal lighting plants with a view to determining the true cost of the service rendered. Unfortunately, the resolution as passed was burdened—in an unfair spirit, we are loath to believe—with a clause providing also for the investigation of the same number of private plants. It was manifestly unfair to ask private owners, in view of the present situation, to expose their business, particularly as the sole question at issue was to determine if the statements of municipal plants as to cheaper service are based on all or only part of the factors entering into actual cost.

PROPAGATION OF ELECTRICAL ENERGY.

Mr. Osmond's communication, appearing in this issue, describes an experimental attempt to modify the transfer of electrical energy along a circuit, in such a manner as to make the modification detectable with the ordinary current-measuring instruments. Such experiments when carefully made are always valuable and worthy of notice, no matter how often they yield negative results, because our conclusions are never so infallible that they do not need continual support by direct or indirect appeals to Nature. Moreover, it is the unexpected which often happens in experimental research, and the unexpected may be of greater value than either the expected or the hoped for. It would, however, have been surprising if Mr. Osmond's experiments had led in this case to a positive result, because the galvanometer or current-measuring instrument could only be expected to give a reading after a lapse of time, from the closing of the voltaic cell's circuit, sufficient for the passage of millions of miles of electric wave flow around it, while the effect to be expected should be greatest at the outset of the flow, and should diminish steadily with time, until when the flow had become steady, it would cease.

It is customary to speak of the mystery of the electrical transmission of energy, and in a certain sense, of course, the mechanism is as yet, we believe, entirely mysterious and unknown. But in another sense, it is not mysterious at all, and is well understood; namely, when we speak of the propagation or transfer in terms of electrostatic or electric flux, without stopping to ask what electric flux itself may be. When we charge a condenser of, say, one microfarad capacity at a pressure of one volt, we know that we have imprisoned in the dielectric of the condenser one microcoulomb of electricity, and that the substance of the dielectric holds five ergs of energy in electric displacement flux. If the dielectric had uniform thickness throughout the condenser, and the total volume of the dielectric happened to be 2 cubic centimeters, then there would be 2.5 ergs of energy per cubic centimeter of dielectric substance, resident in the material and associated with the flux. If we doubled the flux density, we should quadruple the associated energy. But if we take the charged condenser and connect it to a circuit of any kind, the electric flux travels out of the condenser and along the conductors, and with it goes the energy, hand in hand. We have ample reason to believe, moreover, that the flux travels with the speed of light in air. Consequently, when we speak of the electric transmission of energy we mean the transmission of energy accompanying the travel either of the flux; i. e., the thing which permeates a charged condenser dielectric, or else of the strained condition of the charged condenser dielectric, along insulated conductors through space. Half of the energy so transmitted is in the form which is associated with the electric displacement directly, as ergs per cubic centimeter at a given displacement density. The other half is associated with magnetic flux displacement, the magnetic flux being called into existence by the traveling through space of the electric flux.

As the stream of electric flux leaves the source, every cubic centimeter carries a definite amount of energy with it to the distant end of the circuit. Part of it is absorbed by the conductor in transit and converted into heat; part of it is absorbed in the translating devices at the distant end. The remainder goes on around the circuit or is reflected back and returns through the source until, by repeated circuitations, the advanced guard of the flux becomes entirely absorbed. The steady state of electric flow in the circuit is theoretically never completely attained, but, in practice, is usually attained in a small fraction of a second, during which time the wave stream has usually had time to run round and round the circuit a great number of times. During the maintenance of the steady state we have a bundle of wave streams; namely, the stream which is just about to make its first circuitation or the newly issuing stream, also the stream which has passed round once, also the stream which has passed round twice, and so on to the stream which first started, and which has become practically extinct by absorption. In fact, the steady electric current is the sum of an indefinitely great number of electric waves, each of which is a travel of electric flux with its accompanying magnetic flux, and with the energy of those fluxes wrapped up with them and traveling in their arms. The rate of transfer of electric energy at any point is the sum of the energies so carried.

By properly constructing and arranging the circuit the summation of waves may take special forms. The practical problem of transmitting power economically by electricity resolves itself into arranging the circuit in such a manner that the resultant electric stream shall have a relatively high electric flux-density, but a relatively weak magnetic flux-density, along the circuit, except in the transmitting and receiving apparatus, and this we know is accomplished in every high-tension electric circuit where the resultant effect is a relatively large amount of energy stored in the dielectric around the line wires in electric displacement and a relatively small amount of energy in the magnetic flux. We suppose that in Mr. Osmond's experiment the inclusion of the voltaic cell within a conducting box altered the electric capacity of the circuit in the neighborhood of the cell or source, and, therefore, locally affected the distribution of the electric and magnetic fluxes. It, therefore, must have altered the path of the energy streams, since the energy in passing through the box and source must have been confined to the interior of the box and prevented from spreading to the external space. But this would only modify the flow of each wave, and the total amount of energy transmitted through the circuit after the steady state had been attained would be the same whether the box was used or not.

Prospective Development of the Bell Telephone Business.

A great deal has been said lately about the plans to be developed by the American Bell telephone management, but the most comprehensive and striking statement on the subject is that described by the Boston News Bureau as coming from "one closely allied with the telephone managers." It runs as follows: The American Bell Telephone Company more forcibly realizes than ever before the importance of having absolute control; in fact, this was the original purpose of the American Telephone & Telegraph Company, all of the stock of this company now being owned by the American Bell Company. The recent increase of capital stock of the American Telephone & Telegraph Company to $75,000,000 is the first move toward the general amalgamation. The second move was the recent increase of capital made by the American Bell Company's manufacturing concern, the Western Electric Company, of Chicago, New York, London, Antwerp and Paris. This company's capital was extended from $1,500,000 to $6,000,000. The company will quadruple its output by a large increase of its plant in New York and Chicago, as it is utterly impossible at present to supply the demand for material. They are now six to nine months behind on their orders, and are running night and day. The third move in line with the general plan may be looked for before many months have passed and will practically be the final one. A consolidation of this magnitude where so many interests are concerned will naturally take time to amicably adjust and bring about. To handle this business, the capital of the New York Company, the American Telephone & Telegraph Company, would probably be increased to $300,000,000—$200,000,000 to be used to acquire all the telephone properties and $100,000,000 for development. The policy would be to have all the sub-companies go into the amalgamation free from debt, that is to the extent that the sub-companies bonds can be purchased and retired—and to do this a sufficient amount of American Telephone & Telegraph stock would have to be reserved. The various sub-companies would go in on a basis of their capitalization, surplus and earning powers.

The result of a consolidation of this character would be beneficial in many ways. First—An extensive reduction of telephone rates throughout the country, made possible by a large reduction in operation, secured by the dissolution of so many local organizations. Second—An unlimited extension of the telephone business to every hamlet in the United States, and further by connecting every farm house in the land. Third—By entering into a more satisfactory arrangement with the Canadian Bell Company, thus bringing all Canadian points in close touch with each other and the United States.

Arrival of Mr. Marconi.

Mr. G. Marconi, whose name has been so prominent lately in connection with inventions and improvements in wireless telegraphy, arrived in this city last Thursday by the Cunard steamer Aurania, to undertake, first of all, the work of reporting, by his system, the international yacht races, for the New York *Herald* and the *Evening Telegram*. He was accompanied by Mr. W. Goodbody, a director in the Wireless Telegraph Company, of London, which operates under the Marconi patents, and by three skilled assistants, Messrs. C. E. Rickard, W. W. Bradfield and W. Densham. Upon landing, Mr. Marconi took up quarters at the Hoffman House, where he was seen by a representative of the Electrical World and Engineer. He was in good health and spirits, but not a little perturbed by the fact that owing to the dock strike in England some of his apparatus had been shipped by another boat, apparently to Boston. He said that, not being able as yet to use his system across the Atlantic, a good deal of cabling had been necessary to straighten out matters.

"We shall have no difficulty," he said, "in sending the news of the various stages of each race to New York, directly from the scene. I suppose you have already noted my work this summer in the British naval manœuvres. The Admiralty asked me to install my system on board three ships of the fleet supposed to be engaged in defending the coasts of England. The scouting cruiser Juno and the flagship Alexandra were two of three equipped. I was on board the flagship. The scouts were directed to report every vessel sighted, send a description of her, which direction she was steering and everything about her. They also reported routine matters to the admiral. Between midnight and 6 o'clock in the morning we frequently transmitted as many as two hundred messages. Except for these reports, the admiral had no definite idea where his scouts were, nor would the scouts have had of the fleet. The distance between the two, of course, varied; but the system worked well whether it was short or long. From the scout not a trace of the smoke from the funnels of the thirty warships of the fleet could be seen; yet the instrument down in the stateroom was clicking out orders from the admiral every few minutes. Finally the Juno sighted the vessels she was looking for and the message containing this information was sent by the operator on board. Eighty miles distant Sir Compton Domville, in the Alexandra, received the news which enabled him to outmanœuvre the enemy's fleet and win the contest. The same conditions will prevail during the yacht races, with a decrease in the distance to be covered."

Mr. Marconi was asked as to whether his apparatus used here would embody any improvements not yet known.

"Well, I have not by any means made public all the details of my apparatus. Thirty miles, when you cannot even see the smoke of the other steamer, is a great distance. Eighty miles requires quite an effort of the mind to picture, but I must ask you to believe me when I say that with my latest apparatus I consider 120 miles easily attainable, and how much beyond that I am going to find out."

Mr. Marconi stated that he had been invited by the American Institute of Electrical Engineers to appear before that body, after the races, and show his apparatus, and that he hoped to avail himself of the honor. At the moment he was far too busy on immediate work to make any definite plans until later. Upon his arrival he had been met by Capt. G. O. Squier and Mr. Leonard Wildman, of the Signal Corps, on behalf of the government, and he was to undertake some special work for the army and navy before his return to England.

For the yacht races, and the arrival of Admiral Dewey, the *Herald* has chartered a fine new steamer, the Ponce, of about 3200 tons gross and able to make a speed of 17 miles an hour. On her Mr. Marconi will be stationed. There will also be an auxiliary boat under his orders, the Grande Duchesse, upon which will be stationed Mr. W. J. Clarke, of the United States Electrical Supply Company, so that the service to the newspapers interested will be of the fullest and most complete character possible. Mr. Marconi has already got an idea of the scene of the contest, and from the top of the St. Paul Building, some twenty-four stories high, has studied the land contour of Manhattan and the bay. He scouts the idea of any trouble from the tall steel buildings.

Electrical Features of the Export Exposition.

By this week the exhibits at the National Export Exposition in Philadelphia will be in fairly complete shape, and the power plant will also approximate its completion. It is divided into two sections, the boilers occupying one and the engines the other. Two 250-hp Stirling boilers, and two 250-hp Berry boilers are already installed, and the foundations are ready for two 250-hp Heine boilers. In the engine section are a 150-hp Harrisburg standard engine, directly connected to a Siemens-Halske dynamo; a 200-hp Armington & Sims engine, directly connected to two 75-kw General Electric Company's dynamos, and a 100-hp Ames engine, directly connected to a Siemens-Halske dynamo.

In the South Pavilion power is supplied for one line of shafting by a 60-hp Otto gas engine, located on the exhibition floor, while another line of shafting is driven by a Struthers-Wells gas engine of 120-hp.

At night the interiors of the buildings are brilliantly illuminated. Within them are 400 arc lamps of various kinds and designs, of 2000-cp each. These, with a large number of incandescent lamps, are supplemented by the electrical displays connected with the numerous exhibits.

The main building is especially brilliant from the exterior. Upon its roof at regular intervals are high flagstaffs, the tops of which are ornamented by large opalescent globes, and inside of each of these is a large incandescent light. The effect of this, showing nearly 200 lights, illuminating the flags below, is very effective. About the cornices of the buildings, below the flagstaffs, are hundreds of other incandescent lamps, making a line which extends entirely around the structures and marking their outlines from a great distance.

The arches below the great columns are outlined by sixty incandescent lamps, and the pediment above them by more than 100 lamps. High above this is a quadriga, 16 feet high, with the figure of Victory, balanced on either side by groups 10 feet high, representing Transportation and Navigation, all being brought out in bold relief by electric lights.

St. Cloud, Minn., Water Power Plant.

BY F. W. SPRINGER, E. E.

WHILE the upper Mississippi has not a very rapid fall, there being few places on the river of over five feet drop per mile, yet the uniformly high banks render the construction of dams to the height of 20 feet possible at almost any point above the St. Anthony Falls. These falls are the upper limit of navigation, so that the only extra expense in the construction of dams on the upper river is that of sluiceways for logs.

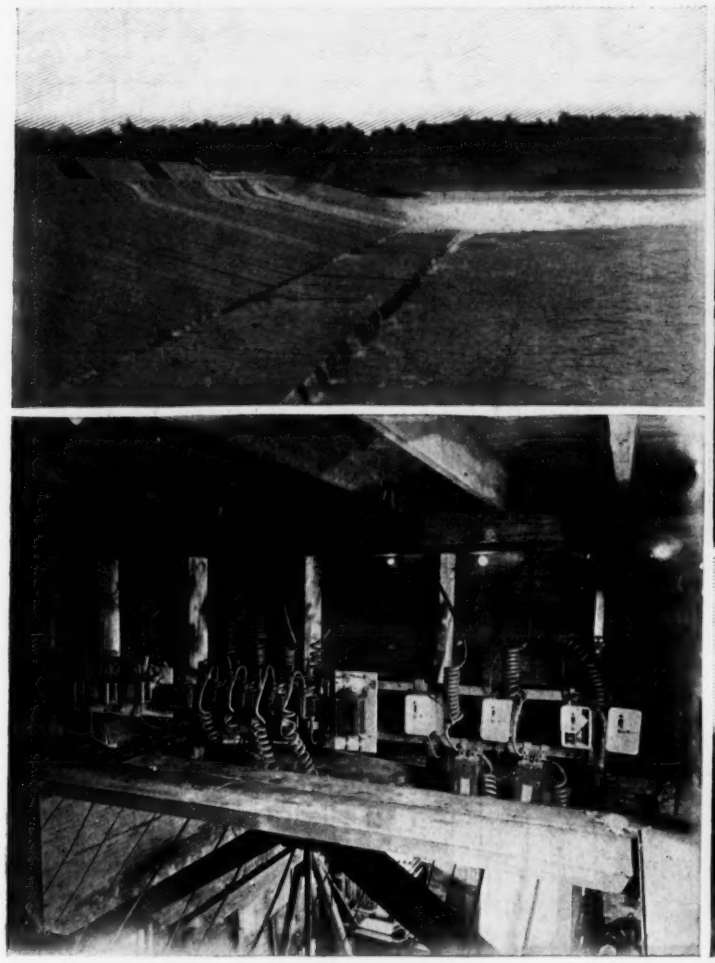
According to Government data taken at Minneapolis during the last 10 years, the minimum flow at that point can be given as 2000 cubic feet per second and a maximum of about 10,000. Owing to the construction of the Government reservoirs at the head of the river, it seems probable that the minimum will not be as low even as is given above.

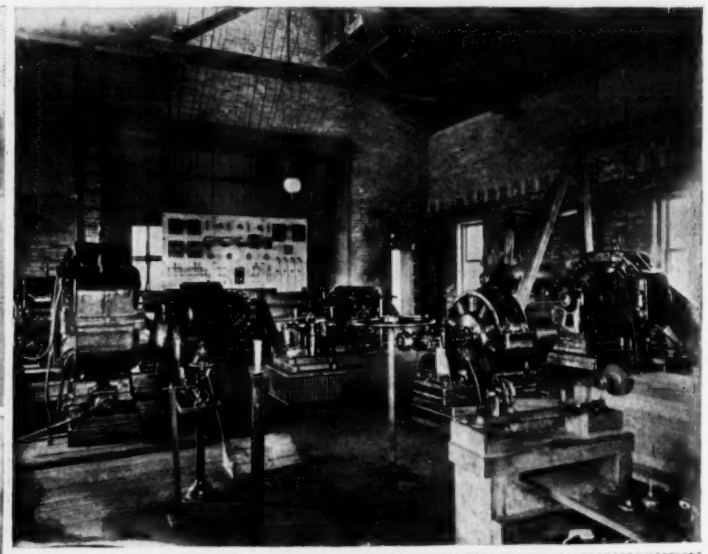
"The Government has five reservoirs in the northern part of the State," says Major Abbott, of the United States Engineers office. "By storing the winter snows and spring rains and letting out the dams about the first of August, the river is raised at St. Paul about 8 inches for about 90 days. Each reservoir costs about 105 a month to run, the salaries of one man at $75 and another at $30. The repairs on Winnibigoshish and Leech lake will cost about $100,000 each. When they are completed, any boat can get to Minneapolis that can get through the locks at Keokuk. A boat 310 feet long, 80 feet wide and drawing 5 feet of water will be able to get through. The largest boat now coming to St. Paul is the City of St. Paul, and it is 290 feet long and 50 feet wide. Congress has appropriated $1,300,000 for the locks and dams between the twin cities, and one-tenth of that amount has been spent."

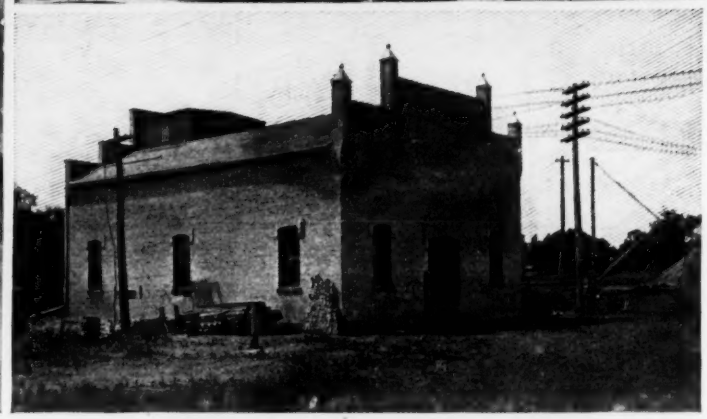
The St. Cloud dam was built about ten years ago at a cost of $150,000. It is constructed of sawed timber, rock filled and plank faced on both sides, and is about 600 feet long. The low water head is 14 feet. Allowing 25 per cent. for the flowage of several small streams, which join the Mississippi between St. Cloud and Minneapolis, gives a minimum flowage of 1500 cubic feet per second and a minimum horse power of 2300. Fig 1 shows the dam during low water.

Water power is rented by the St. Cloud Electric Light & Water Works Company from the Eastern owners of the dam at $10 per hp-year for the full capacity of the wheels, which are Leffell turbine wheels 66 and 74 inches in diameter, and given in the power contract a combined rating of 400-hp.

As this is insufficient to carry the peak of the load in winter, a 150-hp McIntosh & Seymour compound condensing engine belted to a 650-light Westinghouse alternator and 500-volt generator, are being installed at the city water works power house, which is 1½ miles from the dam and practically in the centre of distribution. This is found to be cheaper than to pay the current rate for a water wheel which would be idle most of the time, and is also thought cheaper and preferable to a storage battery plant, owing to the low price of fuel and the fact that a reserve plant is desirable in case of a shutdown at the old power house. The electric power house (Fig. 4) is of white brick, and 34 by 74 feet outside dimensions. The roof was raised last year, making the building a story and a half high. This greatly improves ventilation and reduces the summer temperature. An offset was also built in order to get more light and room back of the switchboard, and a wooden superstructure placed on the roof (Fig. 3) to contain the lightning arresters, the ground for which consists of two No. 0000 copper wires attached to a 4-ft. by 4-ft. copper plate set in water. In the plan of the power house (Fig. 6) the shafts *a* and *b* are in a shaft room below the dynamo room. The wheel house is on the same level as the shaft room.







FIGS. 1, 2, 3 AND 4.—ST. CLOUD, MINN., WATER POWER PLANT.

The following machines are in use: Two 50-light 2000-cp T. H. arc dynamos; one 1350-light Westinghouse alternator; one 650-light T. H. alternator, and two 90-kw 500-volt T. H. compound generators. Each machine is belted to a Hill friction pulley on one of the two countershafts in the wheel room below. The large water wheel, controlled by a Fruen governor, carries the lighting load, and the smaller wheel drives the countershaft to which are belted the two power generators, which furnish current to a four-

car street railway line as well as to a commercial power circuit. The regulation of the large wheel leaves nothing to be desired. As much cannot be said of the other, however. In fact the result of the efforts of the company to keep power customers on a circuit whose voltage varied between 250 and 800 volts, is too evident to be discussed. The smaller water wheel was and is now regulated by a Replogle electric governor. As it very frequently happens that all the cars stop and start at the same time, the load thus varying from nothing to a maximum and vice versa, it is impossible for any governor to give close speed regulation. Under these conditions the speed of the power generators, which run 700 r. p. m. at the normal speed of the water wheel, varies between 300 and 800 r. p. m. Attempts to get a closer speed regulation were finally given up, and efforts directed to shunt-field control, in order to obtain a constant pressure of 500 volts. The T. H. regulator,

The regulation on week days is excellent. On Sundays when there is no load except that of the cars, the voltage will sometimes drop to 300, but never goes above 500.

The City of St. Cloud is built on a granite and iron ridge. This together with being near the river may account for the unusual amount of lightning during storms. The station apparatus and lines seem to be well protected by lightning arresters, yet one of the power generators has been burned out three times in two months. In every case the series field coil grounded on the shunt coil.

The following arresters are used: T. H. arresters on the arc circuits. The alternating current apparatus is well protected by four of the G. E. station magnetic blow-out type, and several swinging ball arresters placed near the centre of distribution. The power circuit, which alone causes trouble, is protected at the station by

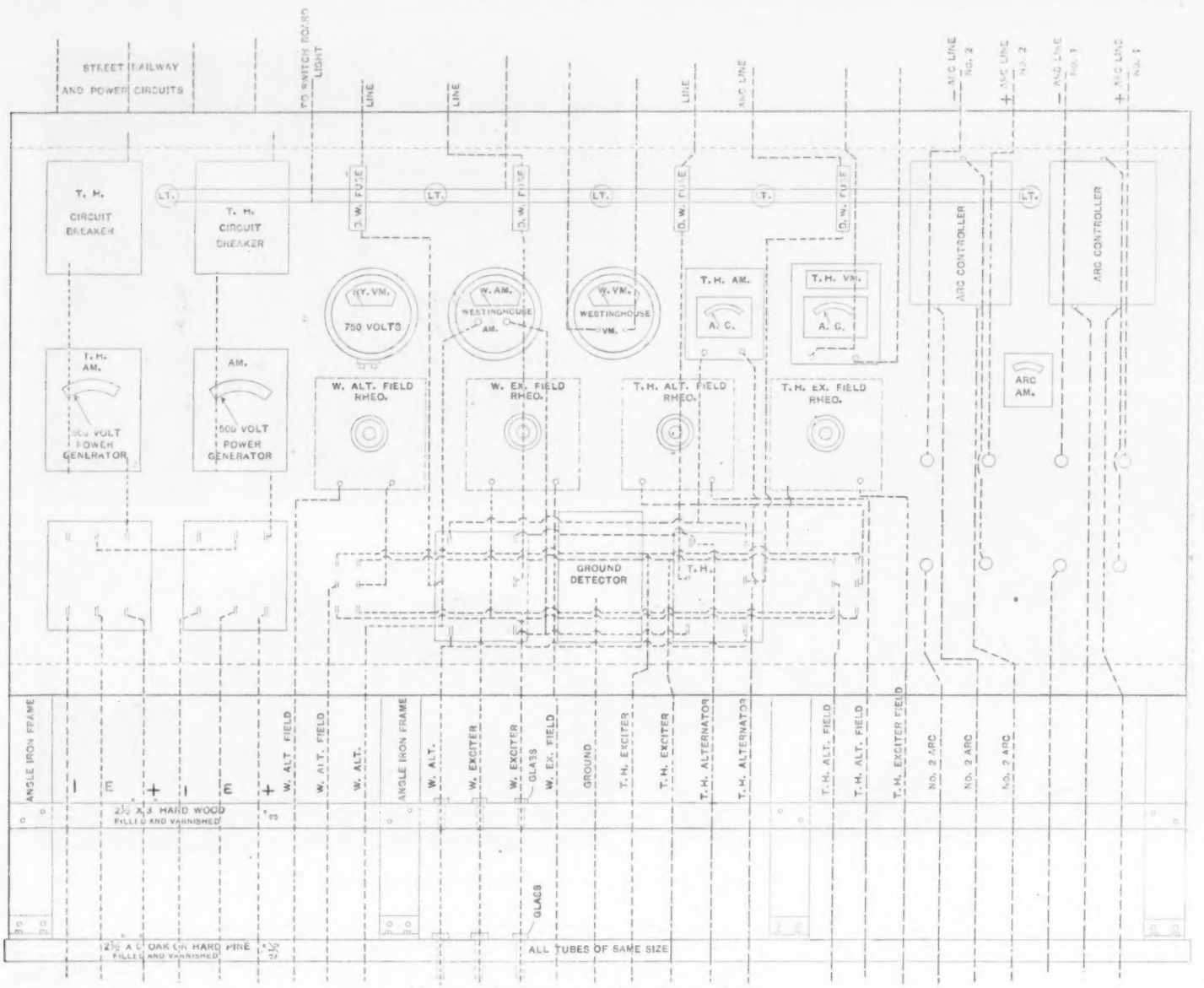


FIG. 5.—SWITCHBOARD, ST. CLOUD PLANT.

which came with the equipment, works on this principle, but has proven itself to be too slow. The problem has finally been solved by speeding up the generators 15 per cent., so as to require a lower shunt field current to generate 500 volts at normal water wheel speed. The shunt coils of each generator were connected in parallel, so that a large exciting current might be obtained with low voltage. These parallel shunt coils were then connected in series with the regulating rheostat of a Chapman voltage regulator. In case the speed, and with it the voltage, of the generators drops, the resistance in the shunt field circuit is rapidly reduced by the regulator, and a sufficiently increased current sent through the shunt coils to offset the drop in speed of the armature by an increase in the strength of field. In fact, this regulating current is, and must be, strong enough to force the field to keep pace with the changes in speed. With increase in speed, the action of the regulator is just the reverse.

four of the General Electric M. D. type and two old-style T. H. magnetic blow-out arresters, and on the line are distributed eight Garton and numerous single shot, short gap, home-made arresters. In addition to these, a water pail arrester will be connected to the line on the approach of a storm (two plates connected respectively to the positive and negative sides of the line and dipped in a pail of water, which is then grounded).

The lines are as follows: Two No. 6 copper arc circuits, with a total of 90 2000-cp T. H. arc lights; two No. 1 1000-volt alternating current circuits; three No. 0 wires used on the positive and negative sides of the street railway circuit. The centre of distribution of all circuits is 1½ miles from the power house. An overhead ground return is used. There are also two commercial power circuits, each of No. 00 wire, which are not connected to the street R. R. feeders except at the bus-bars.

While there is nothing unusual about the switchboard except

that it is extremely neat in appearance and well designed and constructed, it is worthy of mention because it cost the electric light company but a trifle more than that of the material, it being drilled and mounted by the station employees at spare times. It is of three white marble panels bolted to an angle iron frame.

Incandescent lamps by meter are one cent per lamp-hour. Commercial arcs, 2000-cp on the 11 p. m. circuit, are $6 per month.

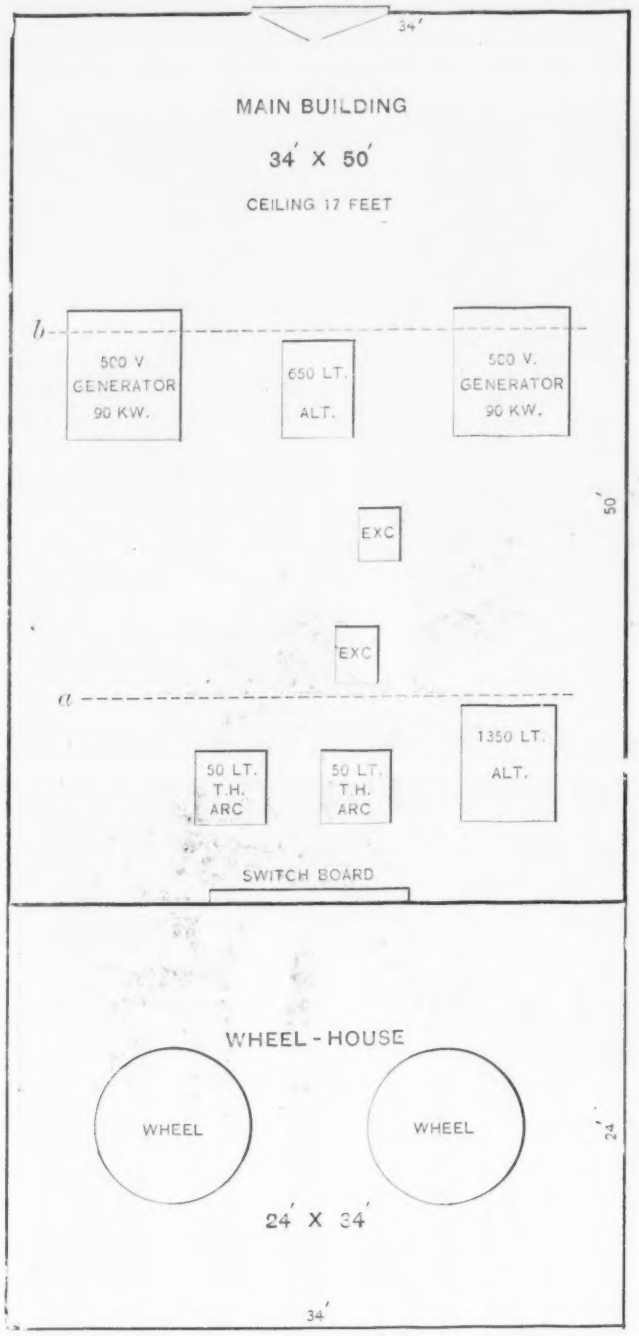


FIG. 6.—PLAN OF ST. CLOUD STATION.

Street arcs, 2000-cp, on all night circuit, are contracted for at $75 a year. On the commercial power circuit a sliding meter rate is used varying between 3½ and 10 cents per kw-hour, according to the amount and when used. The street car company pays two cents per car mile, and owns the street railway feeder system. There are usually three cars, each making about 150 miles a day.

Mr. C. S. Benson, of St. Cloud, is general manager of the electrical plant and water works.

For a Pacific Cable.

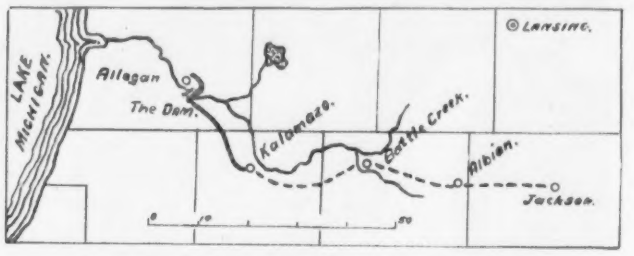
It is reported that a bill is being prepared for the coming session of the Japanese Diet granting a subsidy to a cable company for a line across the Pacific to Japan and the Philippines, the promise being made that rates will thereby be reduced to one-half those now being paid.

Kalamazoo Valley, Michigan, Transmission Plant.

BY EDWARD JAMES HART.

A FEW days ago the ponderous machinery at the new plant of the Kalamazoo Valley Electric Company, some five miles southeast of this town, was started up, and nearly all of the 3000 population of Allegan turned out to celebrate the partial completion of the extensive engineering project for which the company was organized. The whole town celebrated with a parade over the five miles of country road which separates the town from the Allegan dam. The parade included school children, citizens, the local fire department, civic and other societies, and three brass bands, and at a pretty grove near the site of the dam a picnic and barbecue was held.

The ELECTRICAL WORLD AND ENGINEER of March 18 last gave an ac-



MAP OF KALAMAZOO VALLEY TRANSMISSION.

count of the new long distance three-phase, 33,000-volt transmission plant of the Southern California Power Company, which furnishes current to the City of Los Angeles, Cal., from the Santa Ana River, above Redlands, a distance of 81 miles. This is probably the highest potential thus far used in electrical transmission, and the distance covered is the greatest yet attempted for practical purposes with success.

But Michigan is to have a still greater long distance transmission system. It is proposed to transmit power from the dam near Allegan to Jackson, Mich., a distance of ninety miles. It is further proposed

POWER HOUSE, KALAMAZOO VALLEY TRANSMISSION PLANT.

to employ in this transmission a voltage of 40,000 and three-phase currents. It is thought by some that it will be impossible to secure insulation of the line efficient enough, in the damp climate of Michigan, to handle such a voltage, but the promoters of the scheme are sanguine of its success, and the line will undoubtedly be completed to Jackson.

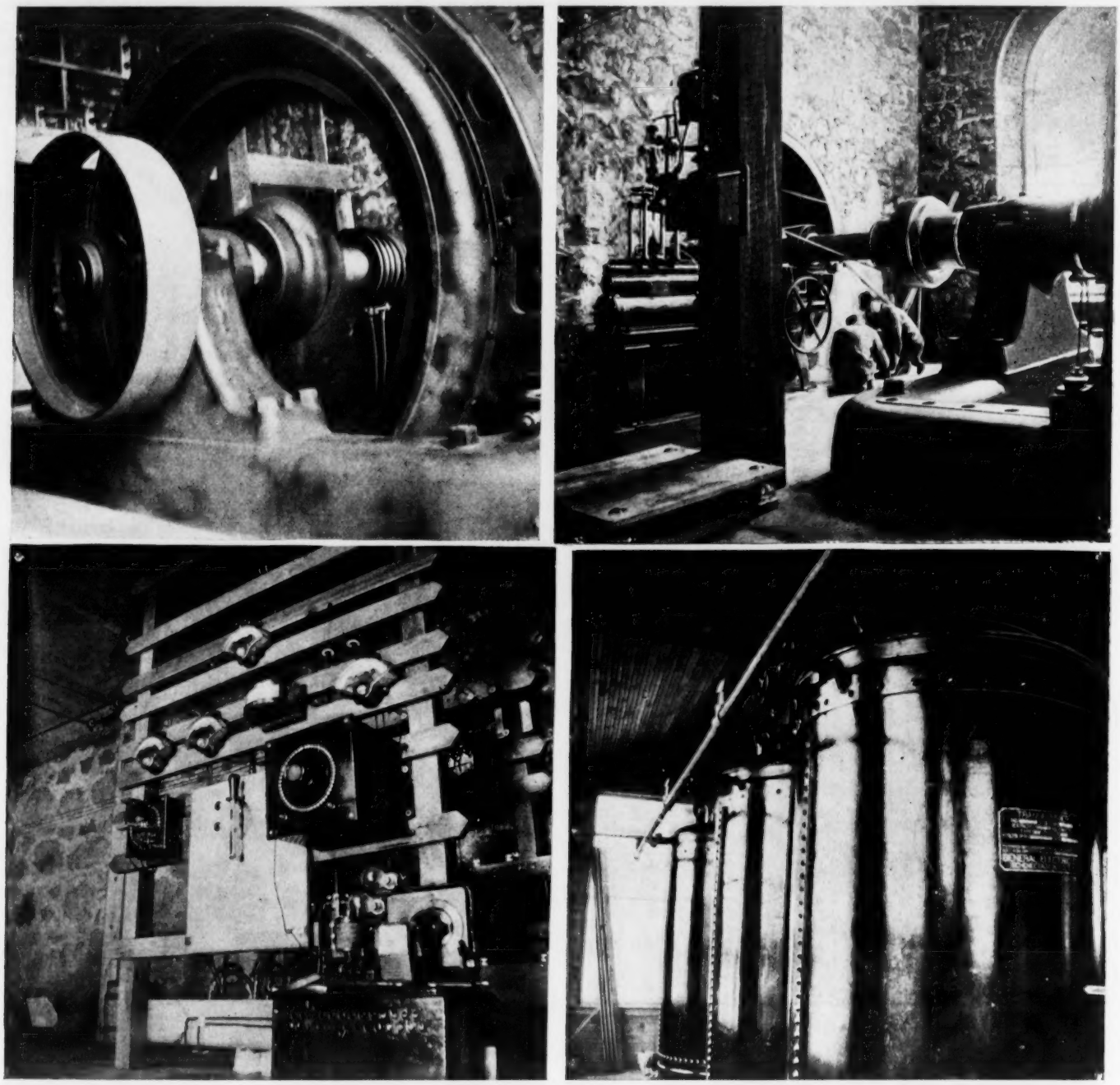
At present, however, the plant only operates as far as Kalamazoo, twenty miles distant, and to Allegan, the voltage being maintained at 25,300. The power is being used for the operation of the Kalamazoo street railway system and for a commercial circuit there. The Allegan line is tapped to only one phase at present, and the street lights and a commercial circuit are supplied. The Jackson line, which will touch Battle Creek and other points on the line, is being pushed forward.

The Kalamazoo River reaches Allegan from the southeast and continues to Saugatuck, where it empties into Lake Michigan. It is not a pretentious stream, but it offers enormous possibilities as a source of power, and it was the realization of this that brought about the organization of the Kalamazoo Valley company. For the past four years the promoters of the venture have been at work securing lands necessary for the river overflowage, rights of way and franchises, and otherwise perfecting their plans. Last October the ground was broken for the foundation walls of the power plant, about four and a half or five miles up the river from Allegan, where the company had secured 1000 acres of land. It is only two or three weeks since the plant was completed, and the carpenters are still at work upon the details of the interior.

The main building is 139 by 33 feet. Three-quarters of its length covers the turbines, the other quarter length being taken up by the generator room and main transformer room. Overlooking the generator room is a gallery where are located the switch racks for the high tension circuits, and the lightning arresters and choke coils. The foundation walls of the upper part of the building, which are the enclosing walls of the lower part, are all of dressed stone, extending to a height of nearly thirty feet from the lower water level, and the building is a model for solidity of construction.

The dam, when the work of water power development is completed, will give a head of 23 feet. At present there is a 19-foot fall. The turbines are eight in number, of the Leffel horizontal pattern, 45 inches, built by the James Leffel Company, of Springfield, Ohio. They aggregate 3000 horse-power, and are arranged upon the same shafting in two sets of four each. The gates of one set are operated by a lever in the generator room, while the other set is controlled by a Lombard governor.

Connected direct to their shaft is the three-phase generator, built by the General Electric Company. The voltage on full load is 2300 and the machine is rated to give 377 amperes. It is rated a 2500-hp machine, but the electrical capacity allowed would indicate more power than that, and in the tests a few days ago it showed up well on a load of 2700-hp. The generator occupies a floor space of 16 by 10 feet, and has a height of nearly 14 feet. Its 50 tons rest upon a foundation of Portland cement and stone. The field rotor has 40 poles, is ten feet in diameter, and makes 180 revolutions. It is excited by a four-pole machine giving 250 amperes at 125 volts.



Turbine, Shaft, Generator, Switchboard and Transformers, Kalamazoo Valley Transmission Plant.

The generator switchboard contains an ammeter, a voltmeter for each phase, with a 22 : 1 step-down transformer, a main generator switch with the contacts in a box of oil at the rear of the switchboard, and a synchronizing voltmeter. Rotary convertors and a synchronous motor at Kalamazoo necessitate the use of the last named.

The three main feeders lead from here to the transformer room.

The transformers, three in number, step up in the ratio of 11 to 1, giving a line tension of 25,300. Each is rated at 500-kw, but is expected to develop a large reserve capacity. They stand nine feet high and four feet in diameter, and are cooled by coils of pipe, supplied by a two-inch pipe leading from a small electric pump in the generator room. They were built by the General Electric Company. From this room the high tension mains lead to the gallery in the dynamo room, where each phase is provided with a rack containing a set of choke coils and 18 lightning arresters of a pattern designed for 2000-volt currents. Upon another rack each of the three mains has its switch—a simple knife-blade, 15 inches in length between the contacts. These switches are not provided with handles, for they are not meant to be handled. Instead a half-inch hole is drilled through the handle end of each blade, and the operator is provided with a polished wooden rod four feet in length, tipped with a brass hook. With this arrangement the switches are thrown.

The line construction is of the most modern type. Thirty and 40 foot poles are used upon the country roads, while 60-foot poles are used within the limits of the towns reached. Long, single cross-arms are used, with tall pins carrying triple-petticoat insulators of glass, seven inches high and seven inches in diameter at the base. No. 4 B. & S. wire carries the currents to Kalamazoo, while the two wires to Allegan are of No. 6 wire. The poles carry also a long-distance telephone line connecting Kalamazoo and the dam plant.

At Allegan the high-tension wires convey the current to a transformer substation in the basement of the city hall, where it is reduced to a voltage suitable for the 60 arc lamps that light the streets, and for the commercial circuits which are operated by the town board. There are three transformers, of the self-cooling pattern, with corrugated iron sheathing. A plug switchboard and the necessary safety appliances are provided.

At Kalamazoo four transformers are tapped upon the three circuits. Two of these step the current down to 2400 volts, for commercial circuits, which supply incandescent lights and power through an individual transformer system. The other two bring the voltage down to 350 for the street railway system. A rotary converter is used which gives 500 amperes on the direct-current side. The power-house is to be provided with another rotary within a short time. The 350-volt current may also be used to operate a synchronous motor in the power house, and the latter used to drive the line shafting and the old direct-current generators. This motor, as a generator, formerly took care of 5000 incandescent lights—it is a 250-kw machine. Of course, both this and the rotaries have to be brought into synchronism with the engine of the plant.

Besides having a contract for cheap city lighting, Allegan has a contract with the Kalamazoo Valley Electric Company for all the power it can use at a very low rate, and it is offering to furnish power to outside manufacturers coming to Allegan at a cost of one-third less than they can secure any other kind of power. A suburban electric line projected from Allegan to Saugatuck is to be operated by power from the Allegan dam also.

But the line to Jackson, carrying 40,000 volts, will be looked forward to with interest by engineers everywhere. Mr. W. A. Foote, the president of the company, who conceived the whole undertaking and has carried it out successfully thus far, owns the electric lighting and power plants at Battle Creek and Jackson, and he proposes to stop his machinery at both places and bring his power from the Allegan dam.

The Kalamazoo Valley Electric Company was organized some two years ago. The company is officered as follows: President, W. A. Foote, of Kalamazoo, Mich.; secretary, S. S. Hulbert, of Battle Creek, Mich.; treasurer, James B. Foote, of Kalamazoo; manager, C. H. Frisbee, of Kalamazoo. The company's electrical engineer is J. B. Foote, and J. C. Riley is mechanical engineer.

The Dewey Welcome.

As this issue goes to press thousands of incandescent lamps are being put in position for Dewey illuminations and a great deal of other special electrical work is being done. The bad weather has hindered preparations. Rough winds from the bay played havoc with the "Welcome, Dewey," electric light sign on the Brooklyn Bridge Monday, and it was estimated that about a thousand of the lamps had been smashed. The letters of the sign are formed with wire so arranged as to make a number of small squares, in the centre of each of which was placed a 16-cp lamp, suspended from the top wire of the square. These lamps were at first hung loosely.

Municipal Ownership Before the Third Annual Convention of the League of American Municipalities.

IN the voluminous proceedings of the recent convention of the League of American Municipalities held at Syracuse, N. Y., Sept. 19-22, the subject of municipal ownership was represented by ten papers and a lengthy discussion. If printed in full, this matter would fill about fifty-five pages the size of the pages of the ELECTRICAL WORLD AND ENGINEER, or fill 300 pages of an octavo volume.

The consideration of the subject of municipal ownership was introduced by a paper by Hon. Robert P. Porter, entitled "Vested Wrongs." Mr. Porter referred to the fact that some twenty-five years ago he was called upon by the United States Government to prepare a report on the wealth, debt and taxation of cities and towns, in which it was shown how the craze which set in soon after the war for municipal improvements became a great evil, and he believed that the present movement for municipal ownership, if successful, would have a similar result. He particularly deprecated any attempt to remove the constitutional limit on state and municipal indebtedness in order to provide municipalization of public utilities. He showed that to municipalize merely the electric railways and gas plants would increase municipal indebtedness from its present figure of $800,000,000 to $3,400,000,000, which he considered to be simply a preposterous proposition.

The sweeping general unsupported charges of advocates of municipalization were denounced, and those which refer to municipal ownership abroad were gone into in detail, Mr. Porter having just returned from a trip abroad, where he had made a study of the subject. He states that the English official returns, as well as those from the last Massachusetts report, are by no means favorable to municipal ownership. As to municipalization of street railways in the United Kingdom, there is much misapprehension on the subject in this country. If an absolutely accurate comparison could be made between the United Kingdom and the United States, it is doubtful which of the two countries would lead in this respect. Considering the four important branches of the service—the supply of water, gas, electric light and street railway together, it is safe to say that honors in favor of these municipalizations would be about equally divided in the two countries

The examples given by writers on vested wrongs are usually based upon stray facts, and in some particular instances probably are true where peculiar conditions have enabled private corporations to drive good bargains with the administrators of public corporations; but the only remedy in such cases is more care in the future on the part of municipal administrators to see that reasonable leases should be made instead of franchises in perpetuity.

Another fact is that such experiments rarely meet the anticipation of the labor side of the problem. Last month newspapers of London were giving in detail the complaints of the County Council Tramway employees who called upon the employees of private corporations to come to their rescue in the fight against the exactions of the municipality as to long hours of labor and other injustices. In America such a question would become political, the men would likely get increased wages, the political party the votes and the taxpayer the bill of expenses.

As to municipal operation abroad, Mr. Porter considers it doubtful when all the important factors are properly taken into consideration if a single instance can be pointed out in which such service is performed better or cheaper or on more intelligent principles abroad than in the United States. The opposition to private ownership in England and to a lesser extent on the Continent has retarded the extension of street railways to meet the pressing demands of population, while in American the reverse has been the case. Here the street railway man has gone ahead and taken his chances with the rest of the community. Although he may have driven good bargains for himself, and directly he may not pay much into the coffers of municipalities, weighed in the balance of good business and common sense he can point to achievements which far outweigh results obtained in England where municipal pettifogging has effectually soaked the enterprise out of street railways. In America instead of petty railway budgets showing so much profit to the municipality, we can point to largely increased real estate values and millions added to the tax rolls, in a large measure the result of street railway extension.

In the matter of charges, the American street railway compares favorably with systems abroad. In New York, for example, transfers have reduced the average fare to about 3⅓ cents, which is less

than the average fares on the Paris tramways and omnibuses, while in London the tramways charge from 2 to 12 cents a fare, according to the distance. That the experiments in municipalization in street railways abroad are inadequate is illustrated by the fact that in Germany, where state ownership of steam railroads has met with a measure of success as a producer of government revenue, the future policy will be in the direction of private ownership and moderate municipal control of street railways.

Mr. Porter referred to the fact that the new phase of municipal administration in its more ambitious form, aims to deal with every question that directly or indirectly affects the life of the people, and carried to the extent in which it has been in some British cities, it is, in fact, municipal socialization. This brings up the question of how far municipalities can go in profit-paying work without undermining the whole fabric of free competition. While the experience of some cities has proved that municipal ownership rendering common service may be of immediate advantage to the public under some conditions, the question arises, "Is not this advantage reaped at the expense of the future?" Do not the economic undertakings of governments only emphasize the failure of governments to govern? In brief, Is the state to be supreme? On the question of how far we can go with municipal operation, there is a wide difference of opinion in the United States.

He quoted from the recent report made by the committee of the New York Legislature, which concluded with the statement that as an abstract proposition, no government, either national, state or municipal, should embark in a business that can be as well conducted by private enterprise, and that the reverse of this proposition carried out to a logical conclusion would put all business enterprise under governmental control and management and leave to no citizen any hope or ambition or aspiration beyond that of seeking a position which affords but a meagre existence. Mr. Porter says there is no more powerful argument against so dangerous a policy than this one put forward by the New York Legislative Committee. There is such a thing as carrying government interference too far, and the danger in all such experiments arises from the fact that one step leads to another. From municipal ownership we may go to municipal socialism, and from municipal socialism the distance is not far to state socialism. Mr. Porter asks if the country is ready for this result.

Mr. Allen R. Foote read a paper on "Public Ownership vs. Regulated Natural Monopolies," in which the economic side of the question is discussed in great detail. The points made by Mr. Foote, which in this case were supported by elaborate argument, were as follows:

1. Practical civil service regulations, strictly and continuously enforced, are necessary to efficient public management; and a just system of profit-sharing with employees is necessary to efficient private management.

2. A uniform system of accounting, prescribed and audited by the state, designed to show the true and entire cost of every public service industry, identical in every particular for public and private ownership and operation, is an indispensable condition of intelligent and just regulation.

3. All true statements of costs must include interest on the investment at the rate paid on its bonded debt by the municipality in which the industry is located; a sufficient provision for insurance against loss by accidents of any kind; the amount of taxes relinquished if a publicly owned industry, and paid if a privately owned industry; an ample provision for insurance against the impairment of investment; the true and entire costs of all materials used and salaries and wages paid, and an accurate statement of all miscellaneous expenses.

4. Prices to users should be based on cost, plus a provision for the refunding of all capital secured by taxation or the sale of bonds in case of all publicly owned, and cost plus a legally limited profit in case of all privately owned industries.

5. Prices should be determined for periods of five years.

6. There should be no free service. All service, public and private, should be valued and paid for at prices determined as specified in proposition 4.

7. No service should be sold at less than cost.

8. The profits of private corporations should be determined and limited by twice the rate of interest paid on its bonded debt by the municipality in which the industry is located, in all cases where costs are calculated and allowed, as specified in proposition number 3.

9. All profits in excess of the legal profit specified in number 8 should be divided equally between municipality and corporation.

10. The initial investment to be used as a basis for these regulations should be determined by process under the law of eminent domain, or by arbitration, as may be mutually agreed upon between the municipality and the corporation.

11. At the expiration of every period of five years the municipality should have the option of paying to the corporation the full amount of its investment and taking possession of the property, and thereafter operating it as a municipal plant, or of determining prices for another period of five years and continuing its contract with the owning and operating corporation.

12. This system of public regulation is preferable to public ownership and operation.

After concluding his paper, Mr. Foote offered a set of resolutions for adoption by the league in conformity with the foregoing considerations, which resolutions were referred to the Committee on Resolutions.

Mr. H. L. Doherty, on the part of the National Electric Light Association, submitted a proposition to the league offering to bear one-half the total expense (said total not to exceed $5000) of employing a competent expert to examine as many municipal electric light plants as that sum will permit. The properties to be examined to be selected by the League of American Municipalities, and the expert to be selected and appointed by the president of the Nationel Electric Light Association, and approved by the president of the league. The result of such examination to be in the form of a report, one copy of which shall be furnished to the league and one to this association.

Upon the motion of a member of the league, the resolution was amended to provide also for the examination of five privately owned plants. The resolution was finally adopted in the following form:

"Resolved, That the offer of the National Electric Light Association to pay one-half of the expense, not to exceed $5000, to investigate municipal plants, the investigators to be appointed by said association, be accepted on the following conditions:

"First: That the president of this league appoint one investigator and the president of the National Electric Light Association another, these two, with any needed assistants, to investigate jointly and report on all points of agreement and disagreement.

"Second: That the investigation extend to the charges for domestic, commercial and street lighting, the cost of coal, the wages and hours of labor in private companies whose conditions are as similar as may be to those of the public plants examined. The presidents of the two associations in conference with their expert investigators to select the plants to be examined, both public and private. In case of disagreement on this point, half of the public and half of the private plants to be selected by each president.

"Third: That in view of the regular dues of the association being inadequate for even ordinary running expenses, the money for this investigation shall be secured by our treasurer from special donations, and our acceptance of the offer under consideration shall be conditional on the raising of this money, for which end we hereby request all those interested to contribute liberally."

At the afternoon meeting of the convention Mr. Doherty informed the meeting that the provision as to private plants was impracticable, as no one had authority to give the privilege of examining into such plants. He believed that the subject of municipal ownership is worthy of a thorough investigation. If municipalities can run electric lighting plants cheaper than they can be run under private ownership, give good service and make money at it, the owners of private ones can go into some other business. He believed, however, that there are some things that private enterprise can do for municipalities better than they can do for themselves. As an illustration from his own line of business, he said there are few central stations which do their own wiring, for the reason they find it more satisfactory to let it out to contractors. The electric light question, he stated, is further removed from the necessity of municipal control than any subject of public utility. Regarding the Bell Telephone Company, the continuance of affairs is entirely different. The United States Patent Office must be blamed for the prices which have heretofore existed for telephone service. Mr. Doherty, in conclusion, said that the injection of the clause concerning investigation of private plants would prevent any practical result from the adoption of the resolution.

A paper on "Fallacies of Municipal Ownership," by M. J. Francisco, of Vermont, was principally devoted to showing the unreliability of statistics of municipal plants, the evil effects that arise under municipal ownership through official corruption, and inefficiency of employees apt to be employed through political considerations. It is a well-established axiom, he said, that to govern successfully requires that one shall be wholly disinterested, while ownership implies the greatest self-interest. Therefore, we have two propositions that are directly antagonistic. The experience of years has demonstrated that at the present time all business enterprise requires rare ability and experience, if not genius, to succeed. Great financiers and successful men have devoted their lives to the study and practice of their trade or profession. How is it possible, then, for municipalities to expect such qualifications from officials whose term of office is only for one or two years? If a municipality had a right to assume the power asked, they could absorb all business and manufacturing, sell all goods and control every branch of trade. This would destroy competition, stop all development and make the restless masses helpless and dependent upon the municipality—mere serfs, in fact. The management of inexperienced politicians would be so unwieldly that there could be no system or economy and the city would become an instrument of oppression, which would eventually result in anarchy.

The true remedy, Mr. Francisco believes, is not municipal ownership, but regulation. By a system of regulation and control such as exercised in Massachusetts, the interest of the public is protected and at the same time the investment of private capital is encouraged and fostered. Mr. Francisco drew a distinction between municipal ownership of water works and electric lights, between which, he stated, there is no analogy. Nature furnishes the water; the apparatus required is simple and plain, not liable to accidents, nor to notable improvement. It is simply the distribution of a natural product. On the other hand, the outfit for an electric light plant and the manufacture of electricity requires the most intricate and complex machinery known to man, and is changing and being improved constantly. This delicate apparatus is subject to accidents of all kinds and a heavy loss in transmission. Within the next few years the inventor may revolutionize the business and the machines in use at the present time become worthless through new improvements. It is expected that a great revolution in the method of generating electricity will be adopted in the near future, and electrical invention being only in its infancy, when it has attained its full growth mankind will look back with wonder at the ignorance displayed by the people of the present generation.

Mr. Francisco examined some of the statistics of municipal plants as to the cost of lighting. In the case of Chicago, the cost of a 2000-cp arc light was reported at $69.35 per lamp per year, but after a careful examination of the business accounts, Mr. Francisco discovered that the actual cost was $165 per year. Under a change of administration, this figure of $69.35 was raised to $96.64, and examination of items showed that the actual cost was then $167 per year. In Swanton, Vt., the total cost of the arc was reported at $26.59 per year, while the actual cost, taking all items into consideration, was $145.44. In Detroit a private company offered to make a contract for ten years at an average price of $102.50 a lamp per year. A municipal plant was installed, and a report made by the authorities in 1897 stated that the operating expenses were $64.19 per lamp, and in 1898 the report makes the operating expenses $51.85. Adding all the items of cost, the actual cost to the city was $120.21 in 1898 and $126.07 in 1897. The decrease in cost for 1898, Mr. Francisco stated, was arrived at by taking it out of the employees' wages.

The whole foundation of municipal ownership, he said, was based upon the assumption that inexperienced employees of the city who did not have a dollar at risk, and in many cases had been given the position as a reward for helping some political aspirant to office, can and will run the plant and manage the business more successfully than members of a private corporation, notwithstanding the latter may have nearly all their property invested in the enterprise and failure means ruin for them. Is it not reasonable to suppose that men under such conditions give closer attention to business and guard and investigate every branch and detail of its work? Mr. Francisco stated that when the advocates of municipal ownership found themselves unable to disprove the facts disclosed as to the operating cost of municipal properties in this country, they immediately fell back upon Glasgow, where the conditions are not the same as in this country, and the government is different. Wages there are less than half those paid in this country, and instead of there being no taxes in Glasgow, they are more burdensome than in the United States. He quotes Mr. Robert Crawford, of Glasgow, a strong advocate of the system in that city, who has stated that after obtaining an insight into the conditions that prevail in American cities, he believes municipal ownership there is an impossibility. Mr. Francisco protests against the comparisons made by advocates of municipal ownership, based not upon the cost of private and public plants as shown at the present day, but referring to charges by private companies years ago when all items entering into cost were much higher.

Mr. Martin Gemunder read a paper on "The Problem of Municipal Ownership," the greater part of which was devoted to the discussion of the question, "Can or cannot the official representatives of the community, acting directly as producers and distributors, secure for their constituents certain required services at a smaller sacrifice of earnings than when such services are furnished by private enterprises?" After an examination of all the factors of cost, two equations, one applying to private ownership and the other to municipal ownership were given, which are identical. Advocates of municipal ownership might, however, take exception to the item of interest included, for the reason that the interest charge under private ownership may be swollen by private greed, and far exceed in quantity the similar factor in municipal ownership; and the advocates of private ownership would contend that operating expenses under municipal ownership, owing to incapacity and dishonesty, are a quantity which very much exceeds the same quantity representing operating expenses under private management.

As to the first-mentioned factor, if it is greater in private ownership, it is simply the fault of municipal management, a fault which could be remedied if the city did not impose onerous conditions upon private ownership. Any excess in this item would be avoided by the city authorities by regulating the size of the bonus for a franchise payment, and in fixing the rates allowed to be charged. The ideal franchise grant would be one which fixed the rates to be charged at such a figure as to reduce the grant substantially to par on a bond basis, and by stipulating such a maximum rate of charges as will allow only normal earnings on a bona fide investment of capital.

An examination is made at length into the relative cost of operation under private and municipal ownership, and the conclusion arrived at that, assuming honesty and competency on the part of city officials, they must necessarily be higher under municipal ownership. Private management and excessive self-interest are always closely associated in the public mind. These traits instead of being faults in private business ventures are the very factors causing economical management. In order that the greatest gains may be realized, work must be skilfully performed and expenses kept down. All losses must be borne by the concern, for there is no accommodating taxpayer to make good deficiencies. In our day when competition for possession of the market is so sharp and severe, rigid economy in production must be the rule of action or the industry is forced to the wall. In a public work, no such deterrent is present, and there is practically no going to the wall.

Without the merit system municipal ownership is impossible, but nevertheless the civil service law is defective in that a tendency will prevail for retaining in office incompetents and fossils; moreover, it affects mainly the clerks and not the higher officers on whom success so largely depends. Even under a so-called business administration of municipalities, there will be many checks to efficiency, owing to the trammels of regulations and division of authority. To be entirely efficient the executive should be given the same tenure of office and plenary powers as is, for example, given the president of a railroad by the stockholders; in other words, be permitted to conduct the city's business as he is permitted to conduct his own private business. Such a condition of efficiency is, however, impossible under municipal government. Mr. Gemunder referred to the loose manner in which municipal accounting is carried on, and says he can hardly conceive it possible that any one having any familiarity with private corporation work and at the same time a knowledge of how public affairs are conducted, can place any reliance whatever on statements of alleged cost furnished in general city reports. It is recommended that in order that a community may be well served at private hands, and in order that proper contracts may be entered into, in future no franchise be granted and no contract awarded to a private corporation operating public utilities that does not provide as a condition the giving of a certified statement to

the proper officers of the municipality. This statement should be filed at stated intervals and give in detail the assets, liabilities of the concern, the receipts and disbursements and such other data as will be needed for drawing correct ideas of the cost of the service. The right should also be reserved to the city of verifying these statements at any time by the books of the corporations.

Mayor Giese, of York, Pa., stated that in York there was formerly one company, which charged the city whatever it pleased for service. The second company asked for a franchise, and in order to get competition this was granted. In a short time the two companies combined and the city was in its former situation. At present a third company is asking for a franchise, but it is feared that the former experience will be repeated. Mayor Giese asked Mayor Gemunder how the city was to be benefited by continuing these private corporations. Mayor Giese advised to elect men to office who look out for the interests of the city. In reply to a question by Mayor Drennen, of Birmingham, Ala., if he would favor municipal ownership under competent city officials, he replied in the negative, for the reason that if the profits were normal and the service was equally good it would be immaterial whether the plant was operated by public or private enterprises, as far as the cost of service was concerned.

Councilman Towle, of Los Angeles, Cal., gave an account of a difficulty with a lighting company in his city, which resulted in the city seriously considering a proposition to build its own distributing plant in order to take advantage of an offer from a transmission company to supply current. The result, he said, was that a satisfactory reduction in the cost of service was procured from the existing company. He advised the mayor of York to have the city build its own distributing system.

Ex-Mayor Taylor, of Bridgeport, Conn., made a defense of municipal accounting. In his city one side is watching the other, and if any man on the one side brings forth a garbled report the other side catches him at it every time. He contended that the scheme of municipal regulation submitted by Mr. Foote required acceptance by municipalities of the reports of private corporations, though those advocating private ownership would not accept the figures submitted by municipalities.

In a paper entitled "A Business Argument Against Municipal Ownership," Lieut. J. B. Cahoon confined himself, as the title of the paper indicates, to the business aspects of the question under discussion. He pointed out that while the citizen is, in the theory of our government, guaranteed certain freedom of action and may enter upon business in competition with his neighbor and do all that is legitimate and right in getting just return for his labor and expenditure of capital, the instant he joins his capital with that of others and places it in a concrete form and starts in business, he becomes the object of attack. If he seeks to manufacture gas or electricity or operate a street railway, light, water or telephone company, burdens of various kinds are placed upon his business. The right is desired for municipalities to step in and injure or destroy the hundreds of millions of capital which have been employed in such public utilities which amounts to the ruin of the private owners. In most of the states the municipality can step in and thus render worthless the capital and labor which have been put into properties by private individuals. Even if an offer is made to purchase an existing plant at fair value, those interested in its operation are deprived of the right to do business in the only way with which they are acquainted. Private capital may embark in enterprises more or less uncertain, and after infinite pains just succeed in getting itself in position to reap a fair return, when the principle of municipal ownership is applied and the owner ousted from his business. It is asked, Where is municipal ownership and state ownership going to stop? Where will the line be drawn? How are people to earn their living in the future, and where will there be a field for the investment of capital in private enterprise? An examination is made of the elements necessary for the efficient operation of an electric lighting and street railway plant, and it is pointed out that in no manner can the conditions for efficiency in operation be met as well under municipal as under private ownership. Those conducting a municipal plant mean to do well and try perhaps to be economical, but they have not the incentive to reach the point of economy that the employee of a private plant has. In a private plant it is a case of watching every penny, doing the work well, or be displaced by some one who will do it properly.

Mr. Cahoon argued strongly for an identical system of accounting being legally prescribed for private and municipal plants. He referred to the unreliability of cost given in reports of municipal operation, many charges being usually omitted that should have been made against the operation of the plant. Among such omissions are generally municipal and state taxes and in some cases interest charges, while few, if any, municipal plants charge anything to depreciation, and none of them make provision for the time when the bonds come to maturity.

In conclusion, Mr. Cahoon stated that the private corporation today knows from past experience that if it invests its money in any one of the public franchises, it can expect no more than a reasonable interest on that investment, and it is satisfied to deal fairly with the community, even to let the community see its books and see that it does not make and cannot make more than a fair return on its investment. He asks, Should not the municipality be willing to grant this and step aside from its position of municipal ownership and enter into a fair contract with a private corporation, and the two—the private and municipal corporations—unite and work in harmony for the mutual good of all?

In reply to an inquiry from Mayor Brennan as to whether the people got the benefit when private concerns cut down expenses, Mr. Cahoon said that it depended entirely upon how the laws of the state were framed and administered. In the State of Massachusetts electric light plants and gas plants are required to make sworn statements from year to year. In the State of New York a sworn statement is required as to street railways, which statement shows every item of expense, assets and liabilities down to the minutest detail. In reply to a question as to whether it was not the lower wages paid by the private plants which enabled them to operate at a lower cost than municipal plants, Mr. Cahoon replied that while this was a factor, yet the main factor was the efficiency of operation and incentive to economy which private ownership engendered. The fact that municipal plants earn no profit means that private plants pay a dividend to the stockholder, while the citizen who is a stockholder in a municipal plant gives up his dividend. The statement having been made that some corporations pay large salaries for which no service is rendered, Mr. Cahoon replied that if a man is paid for nothing his payment is not a legitimate salary.

The first argument for municipal ownership was delivered by Mayor Henry V. Johnson, of Denver, Colo. In opening he said that the question under discussion, like all others which the human race have solved, must pass through the crucible of investigation. It must stand the test of criticism and opposition; must pass through the fire of actual trial and experience. Unless, like the pure gold, it comes forth brighter and unharmed, it is sure sooner or later to be relegated to that vast graveyard prepared for those things which the human family have "tried and found wanting."

As concerns the matter of municipal ownership, the city ranks far ahead of the individual person, and as the interest of the entire family exceeds the interest of a single member of the family, just so the interest of the entire city far exceeds the interest of any individual citizen or set of citizens. It has been finally settled that the municipality can under the law undertake the business of operating public utilities. The whole question, therefore, resolves itself into one of practical business expediency and economy. Mayor Johnson examined in turn the questions of municipal ownership of waterworks, gas and electric plants, street railways and telephone. Statistics were presented showing that after Glasgow obtained ownership of the gas works, the price was reduced from $1.20 to 52 cents per thousand foot. He stated that upon carefully drawn plans and specifications already made, Denver can build her lighting plant for $250,000, and would furnish her streets with the same number and power for $50,000, for which she is now paying $100,000, and pay for the plant in five years. The argument for street railways was based largely upon statistics of the municipally owned and operated plant of Glasgow and the plant at Toronto, which is owned by a municipality and operated by a private company. The argument for telephones is that they are public utilities and that a telephone system is naturally a monopoly. Statistics were given to show that independent telephone companies, by their charges, have proved that the charges of the Bell Company are excessive. Under municipal management, by eliminating private gain, Mayor Johnson believes that telephone service can be provided so cheaply as to be placed within the reach of almost all. The paper ended with a denunciation of combines and trusts. They were, moreover, referred to as showing what is possible to be done under combination. It was asserted that what capital is doing for itself the people can do for themselves in the operation of public utilities. Trusts are a great object lesson to the people as showing how immense savings are made and how the cost of operation is made cheaper and cheaper, and from this lesson the people will

finally understand that water and light and transportation and telephone message service are actual necessities; that they are such necessities that no man or set of men should be allowed to speculate in or to handle for profit; the people will learn that they can produce them for themselves cheaper and better than any one else can so so for them; and when they do learn this, then cities will own and control and operate all such public industries.

Mayor J. R. Robinson, of Colorado Springs, Colo., based his defense of municipal ownership upon two principal arguments, one being that such ownership would reduce the corruption of municipal government and that it would serve to firmly establish the merit system. While character and comfort or material welfare is the desideratum and legitimate end of all government, he held that morality, public and private, is to be preferred to wealth. The ablest and most conscientious students of modern municipal government conclude that the most prolific cause of political corruption in our cities to-day is the greed for franchises for public monopolies manifested by private capital. This corruption does not end with members of the city government, but extends to legislatures, affects in many instances, the press, to which must be added the judicious distribution of "stock" among citizens of influence and high standing, and who later form a bulwark against any movement for public ownership or control, no matter how desirable these may become.

Mayor Tafel, of Cincinnati, O., in a paper on municipal ownership of public service industries, devoted himself particularly to waterworks, using figures applying to the Cincinnati waterworks to support his arguments showing the desirability of municipalities owning and operating public utilities. As to street railways, gas and electric light, he believes that the use of the streets of a city has a value commensurate with the size of the city, which value should accrue to the community and not to private persons or corporations. By public ownership the baneful influence of corporations on municipal life can be eliminated, resulting in incalculable gain from the standpoint of morality alone. The merit system is announced a prerequisite to ownership and operation, and a greater measure of home rule is desirable for the same purpose, so that the cities may be secured against the continuous meddling of state legislators. In order that public utilities may be safely managed by the community, there is also a necessity that there be a distinct separation of the executive and legislative departments of the city government, and that the executive department, to whose charge the management of public service industries should be entrusted, should have at its head one official who should be held responsible for its proper administration, and endowed with the necessary powers.

Mayor John MacVickar, of Des Moines, Ia., in a paper on "Municipal Ownership," said that the question involved is, Shall the responsibility of furnishing to a community public necessities such as electricity and railway service, be assumed by the municipality and conducted with a view to eliminating the element of profit, to the end that these services shall be furnished at the lowest possible prices; or shall this privilege be left to the individual or corporation to use as a means of acquiring princely fortunes by extorting excessive rates from the public? He admitted that some of the opposition to public ownership comes with sincerity from those who failed to see the evils of private ownership or the advantages of municipal ownership; but the greater part, he believes, comes from those who are directly or indirectly interested in the immense profits derived from the operation of the franchises.

Charges were made by Mr. MacVickar that at both the Columbus and Detroit meetings attempts were made to manipulate the League in the interests of franchise-holding corporations. As to the charges of corruption from municipal ownership, where there is a bribe taker there is always a bribe giver, and the principal bribe giver in the community is not the advocate of municipal ownership, but is proved in more than one instance to be the representative of the private corporation. In Des Moines there is never, he stated, a municipal election but one or more of the franchise corporations are contributors to a corruption fund to aid candidates whom they believe will best serve their interests. It is charged that supporters of private ownership laid down formulas or rules to be followed in order to arrive at the true cost, which were generally so vague and complicated as to leave the reader in a dazed condition when he attempts to sum up the case. As to regulation, Mayor MacVickar said that judging from the experience of Des Moines, it is impossible to secure by legislative enactment a rate that will at all times and under all conditions be reasonable and just, as watered stock and misleading misrepresentations if the courts are appealed to, and corruption or ignorance, if the municipal legislation is relied upon, will always preclude a reasonable rate to be maintained. Again, the constant changing of conditions affecting cost of production will make the actual cost from year to year impossible to determine. He considers it is less impracticable to own and operate such industries by the public than to secure and maintain without legislation a reasonable rate for service.

He said that Des Moines secured from a gas company a reduction of $1.75 per thousand to $1.30 per thousand after the company had proved to the satisfaction of the courts that gas could not be manufactured in that city for less than $1.75. Until three years ago the city had been paying $126 per annum for arcs, but upon the city making inquiries concerning the feasibility of a municipal electric plant, an offer was received from the private company to furnish lights for from $60 to $65 per annum. Mayor MacVickar took up in turn the various factors laid down by Mr. Foote as necessary in the scheme which he presented for the regulation of private service. He objected to the item of profit being charged to a municipal plant, as a municipal plant has no desire to exact a profit on its investment. He objected to the item of depreciation due to reduction of market price for apparatus which becomes commercially useless through the progress of the art, for the reason that the city does not wish to dispose of its apparatus. A sinking fund he did not consider necessary after the redemption of the securities issued to build the plant. He also objected to the item of repairs and displacements and betterments, for the reason that a reserve fund is also provided for, which would take in these items. He considered that Mr. Foote's proposals involved robbing municipal ownership of all the advantages claimed for it by requiring that a law be enacted forcing municipalities to accept the results of inequitable comparisons, and municipal ownership is not credited with some of the advantages aside from cost of service which would redound to the people, such as improved service, better electric lighting, more efficient public lighting, the removal of a constant source of corruption and menace to good city government, higher wages to labor and lower salaries to heads of departments.

Mayor L. G. Pierce, of Marshalltown, Ia., gave an account of municipal ownership in his city of 12,000 inhabitants, which has operated a water works system for the past twenty-three years and a street lighting system for the past twelve years. He stated that under this system the total municipal debt is $71,000, while the two plants could be sold on twenty-four hours' notice for over $300,000. The assertion was made that in his town 109 arc lights are operated at an expense of but $2367 for operating expenses and improvements. Adding to this amount 10 per cent. of the entire cost of the plant, which to date has been $16,000, for interest and renewals, this results in the rate of $36 per light per annum. Statistics are given of ten Iowa cities, ranging in population from 9400 to 22,000. One of these cities owns both water works and street lighting plants, and two of them own water power plants. It is claimed that the statistics given prove that the latter cities not only receive their water and light at a much less cost, but that the tax is also very much less than in the seven cities supplied by private plants. The general assertion is made that under municipal ownership the public is better served in both fire protection and lighting service, the indebtedness of the municipality is less, the rate of taxation lower, improvements are greater and the people are better satisfied. He believed that under municipalization, a new era will be inaugurated in municipal affairs, and that municipal taxes will be so small in consequence of the revenue derived that the burden will not be noticed.

In reply to a question put by Mayor Stetson, of Gloversville, Mayor Pierce said that in estimating the cost of electric lighting, no allowance was made for buildings and nothing for the boilers, as the water works, building and boilers were used. Two months' coal bill each year was charged to the electric light plant. The salaries of the three men operating the water plant was raised $25 per year when the electric plant was installed, and this formed the labor charge for the electric lighting plant.

Prof. Bemis was requested by the presiding officer to address the meeting on the subject of "Municipal Ownership." He stated that he would make some offhand remarks on the papers that had been presented, and proceeded to criticise the various papers, stating, however, that he would reserve criticism in detail for a communication to the transactions of the league. The remarks of Prof. Bemis would fill about eight of our pages, and as they are criticisms of detail, it would be difficult to give any satisfactory abstract of them in the space at our disposal.

The Action of the Polyphase Induction Motor Graphically Explained.

By Wm. Baxter, Jr.

THE theory of the rotating field, or, more properly, the manner in which currents of symmetrical phase displacement passing through coils symmetrically disposed around a centre develop a rotating magnetic flux, has been so thoroughly explained, and so often, that it would be a waste of time to consider it in this article. The manner in which this flux acts upon the coils that develop it, as well as upon those of the armature, has not been so fully elucidated, and there are many to whom it is still a hidden mystery. It is here proposed to explain the entire action by means of simple diagrams. We will start by showing the nature of the inductive action in the field coils, when the current in the armature is zero, a condition that can be attained by running it in synchronism with the field. This will be followed by a consideration of the changes brought about when a current begins to flow in the armature coils, and several other points which will be mentioned at the proper place.

When the armature of an induction motor is run in synchronism with the rotating flux, the current in its coils will be zero, and the induction in the primary, or field, coils will be that due to the action of the field developed by the primary currents. This action will consist of two parts, that produced by the flux that rotates within the field, and which may be called the useful field, and that produced by the flux which cuts the conductors, but does not pass through the space occupied by the armature. These two inductions will be out of phase with each other, the latter being in phase with the current and the former lagging behind it by an angle that is dependent upon the hysteresis loss and the ampere turns required to magnetize the field.

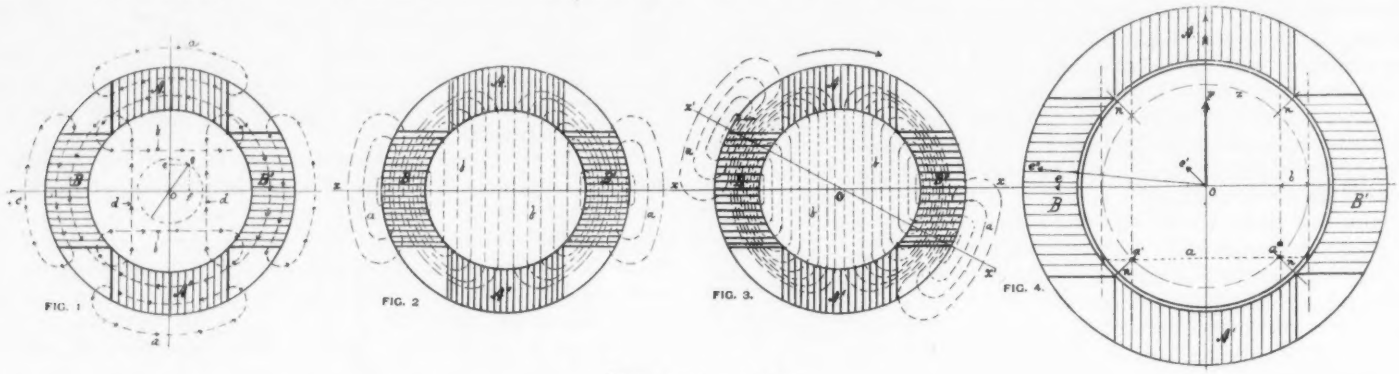


FIG. 1. FIG. 2. FIG. 3. FIG. 4.

Figs. 1, 2, 3 and 4.

Let Fig. 1 represent the field of a two-phase motor of the bipolar type. Let $A\ A'$ be one set of coils and $B\ B'$ the other set. The winding here shown being that of a Gramme ring armature which is used for the purpose of facilitating the elucidation of the two inductive actions. If the armature is removed from the centre space, the air path through the centre will be nearly as great as that around the outside; therefore, the density of the flux along the paths $b\ b$ will be not much lower than along the outside paths $a\ a$. If the armature is put in position the air space will be greatly reduced along the paths $b\ b$, and as a result the flux in paths $a\ a$ will be of a much lower density than that along $b\ b$. If the iron core of the armature is so large as to nearly fill the entire space, or, in other words, so as to reduce the air gap to the lowest practicable point, then the flux along $a\ a$ and $c\ c$ will become exceedingly small, but theoretically, even if all the air gap were filled there would still be some flux along the outer paths, the magnitude thereof being dependent upon the ratio between the reluctances of the main path through the armature and the leakage path through the air.

When the flux developed by the current flowing in coils $A\ A'$ becomes zero, Fig. 1 will be changed to the appearance shown in Fig. 2. Now if the armature is still removed, the lines of force passing through the centre space will occupy a little more than one-half the width of the field ring, and the lines of the external fluxes will occupy the balance of the cross-section. The length of the iron portion of the circuits of the inner and outer fluxes will be practically equal, and therefore the retardation of the rise and fall of magnetic density in both will be about the same, so that both fluxes will reach their maximum values at the same instant of time. When the armature is introduced into the centre space, the iron portion of the inner magnetic circuit will be greatly increased and at the same time this flux will occupy a much greater portion of the field cross-section. If the air gap between the field and the armature core is made small enough the inner flux will practically occupy all the field core cross-section, and the outer fluxes $a\ a$ will be located wholly in air and will only surround some of the turns of the $B\ B'$ coils upon the outer layers. Under these conditions, the hysteresis retardation will be great along the inner path, and practically nothing in the outer circuits $a\ a$, and, as a result, the rise and fall of flux density in the two paths will not be coincident; on the contrary, the outer fluxes will reach the maximum value ahead of the inner one.

As is well known, the action of the two inner fluxes, $b\ b$ and $d\ d$ in Fig. 1, when combined according to the principle of the parallelogram of forces give us a resultant that rotates around the circle as the individual component fluxes rise and fall in value. Now the same combination of the outer fluxes $a\ a$ and $c\ c$ will give an outer rotating flux, hence the fact that the outer flux reaches the maximum value sooner than the inner one, when the armature is in place, can be represented diagrammatically by showing the outer flux ahead of the inner one in the direction of rotation, as is illustrated in Fig. 3. Where the inner flux $b\ b$ is at right angles to the line $x\ x$ and the outer fluxes $a\ a$ are at right angles to the line $x'\ x'$.

The inner flux $b\ b$ in Fig. 3 is not the only flux within the ring, for at the extreme sides of it there are lines of force that surround some of the field wires but do not pass through the iron either of the field or the armature core. These lines not being retarded by hysteresis, must necessarily be in phase with the outer fluxes $a\ a$, but they are not shown here for the sake of not creating confusion by a multiplicity of lines. All the flux $b\ b$ that is at right angles to line $x\ x$ develops in the coils $A\ A'$ and $B\ B'$, as the field rotates, an e. m. f. which we call the counter e. m. f., and it is in phase relation at right angles to the field. All the flux in paths $a\ a$ and all that within the field that is at right angles to line $x'\ x'$ develops in the field coils an e. m. f. that is out of phase with the counter e. m. f. being ahead of it by the angle $x\ O\ x'$. This latter e. m. f. is the reactance e. m. f. and is at right angles to the current flowing in the field coils being behind it in phase.

Since the flux at right angles to line $x'\ x'$ is very small, compared with the useful flux $b\ b$, the reactance is insignificant when compared with the c. e. m. f., as is illustrated in Fig. 4, in which $O\ e$ is the c. e. m. f. developed by the flux of magnitude $O\ F$ and $O\ e'$ is the reactance e. m. f. The resultant of these two e. m. fs. is $O\ e''$ and this, in combination with the e. m. f. required to force the current through the field coils, must be balanced by the impressed e. m. f. of the primary current. In Fig. 4, $O\ e'$ is drawn much larger than it should be. The resultant e. m. f., $O\ e''$, is the total inductive action that the field coils are subjected to when there is no current flowing in the armature. When a current flows in the armature the position of $O\ e'$ will change with reference to $O\ e$, the angle between them being increased; on this account it becomes necessary to investigate the action of each e. m. f. separately.

Looking at the flux, as shown in Fig. 3, the natural inference would be that if it remains of uniform value for all positions, the sum of the c. e. m. fs. induced in the two sets of field coils $A\ A'$ and $B\ B'$ would not be the same for all positions of the flux; for when the direction is as in Fig. 3 the entire flux is not effective, since that portion on each side that cuts through the B coils produces no inductive action. That this is the case can be seen at once, for above the line $x\ x$ the inductive action in B is opposite to that below the line, and as both actions are equal they neutralize each other, therefore the sum total of the induction developed by the flux in this

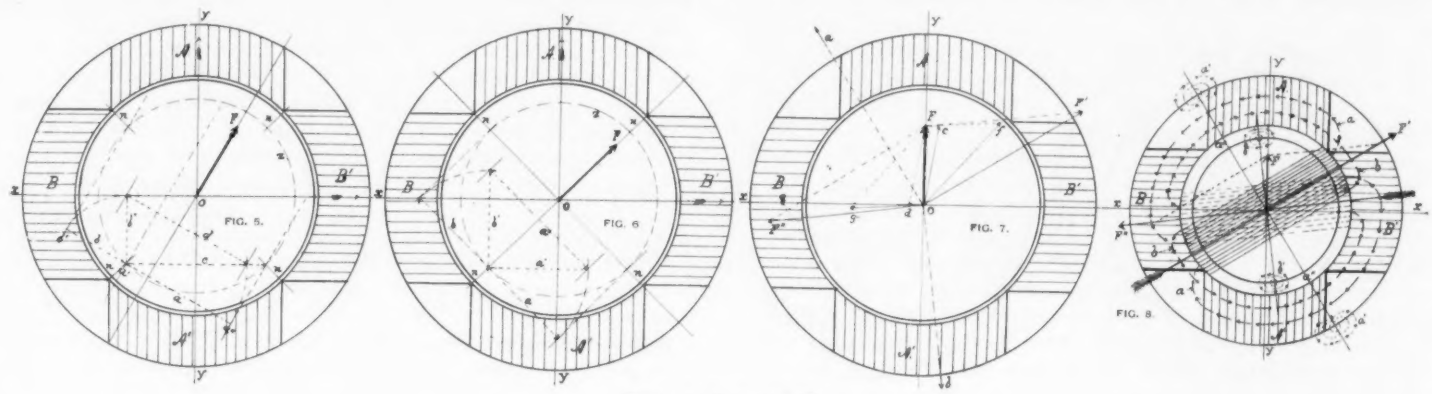
position is that due to the lines of force that cut the *A A'* coils. Now if we consider the conditions when the field has rotated 45 degrees we will see that then the entire flux is active, and that one-half acts upon the *A A'* coils and the other half upon the *B B'* coils. Although apparently the total induction in the two positions of the flux is not the same, as a matter of fact, there is no difference, no matter what the position of the magnetization may be. This is clearly shown in Figs. 4, 5 and 6. In the first figure let the circle *Z* be drawn with a diameter equal to the line of measurement representing the magnitude of the total field flux. Since this circle is smaller than the inner diameter of the ring that represents the field, we must project the diagonal lines *n* until they intersect it. The portion of the flux that passes between *a'* and *a''* (the direction of the flux being *O F*) represents the magnitude of the e. m. f. induced in the coils *A A'* and the remaining portions *b* on either side of this act upon the coils *B B'*; but above the horizontal line they induce an e. m. f. that is opposite to that induced below the line, hence the total action in the *B B'* coils is zero, and thus line *a' a''* measures the total inductive action for this position of the flux.

In Fig. 5 the flux is rotated into the position shown by *O F*, and we see that the portion *a*, between the points *a'* and *a''* cuts through coil *A'* and a corresponding amount through coil *A*, while through coils *B* and *B'* the remainder of the lines of force cut; but all this remainder is not effective, only the portion between *a'* and *b'* serves to develop an e. m. f. Now the two e. m. fs. *a* and *b* induced in the two sets of coils are in quadrature with each other, hence they must be combined by the parallelogram of forces, which we do by swinging *b* around to position *b''* and *a* into position *c*, and the resultant of these is *d*, which is equal to *a* in Fig. 4.

In Fig. 6 the whole of the flux is effective, for now the angular position is such that no part acts in opposition to the remainder. The two e. m. fs. *a* and *b*, however, we must again combine by a parallelogram and thus obtain as their resultant the line *a'*, which is of the same length as *d* in Fig. 5 and *a* in Fig. 4.

When the armature is allowed to run at such a velocity as the field flux will impart to it, its speed will at once drop below synchronism, so that its conductors may be overtaken by the rotating lines of force and thus have e. m. fs. induced in them. The velocity that the armature will attain will depend upon the power the motor has to develop and also upon the resistance, reactance, etc., of its coils. If the impressed e. m. f. of the primary currents remains constant, the strength of the field will be slightly reduced, for we will now have to provide a sufficient e. m. f. to balance the increased e. m. f. required to drive a stronger current through the field coils and this increase must be deducted from the e. m. f. which when there was no current in the armature was used to balance the reactance and the counter e. m. fs. If the velocity of the armature is such that the current flowing through it develops a magnetic flux equal to *O d* in Fig. 7, then the primary current will have to increase enough to develop the flux *O c'*, this being of such magnitude and in such an angular position that in combination with the armature flux it can produce the resultant *O F*. Although *O F* will gradually decrease as the armature current and the magnetization developed by it increase, we will assume it to remain constant so as to simplify the explanation, leaving for future consideration the effect of reduction in *O F*. If the armature velocity is reduced to such a point as to increase the flux developed by the armature current to the value *O g*, then the primary current will have to increase until it is capable of developing the flux *O f* so that the resultant of these may be the standard field flux *O F*. When the armature magnetization increases to *O F''* the field magnetization will have to increase to *O F'*. As there are now two magnetic fluxes acting upon the field coils, the e. m. fs. induced become apparently somewhat complicated, for the primary current flux *O F'*, for example, will induce an e. m. f. in the direction *O a*, that is, this will be its phase relation, but in magnitude it will be much greater than the line *O a*; in fact, it will be to *O F'* as *O e* is to *O F*. The armature flux corresponding to *O F'* is *O F''*, and this will induce e. m. fs. in the direction of line *O b* and of a magnitude that will be to *O F''* as *O e* it to *O F*. The combined effect, however, of these fluxes is the same as that of the single flux *O F*.

Fig. 8 shows the direction of the lines of force of the armature and field fluxes, when the magnitude and phase of these is such as to give the resultant field *O F*. The arrow lines *a a* represent the field flux, and the lines *a' a'* represent the outside field flux, and this, as we have explained, includes also the internal flux that does not pass through the armature. This flux, which is the leakage or reactance flux, is not directly on a line at right angles to the field flux, but is in advance of this position, being at right angles to the current that develops the field flux, hence the reactance e. m. f. induced in the field coils by this flux will still be at right angles to the field current, just as in the case when no current flows in the armature. The arrow lines *b b* indicate the armature flux, and at *b' b'* are shown a few lines that pass through the armature but not through the field coils. These lines of force constitute the reactance flux of the armature, and like the field flux of the same kind, are not in phase with the balance of the armature flux, but in advance of it.



FIGS. 5, 6, 7 AND 8.

The angle by which these leakage or reactance fluxes lead the main fluxes of which they are a part will be considered more fully hereafter. In induction motors as actually constructed, the field coils are not wound Gramme ring fashion, as shown in these diagrams, hence the flux that develops the reactance in the field coils is within the field, in the air gap between the armature and field cores and also on the sides of the field where the coils turn up. The fluxes *a' a'* therefore are actually located at the points *a'' a''*.

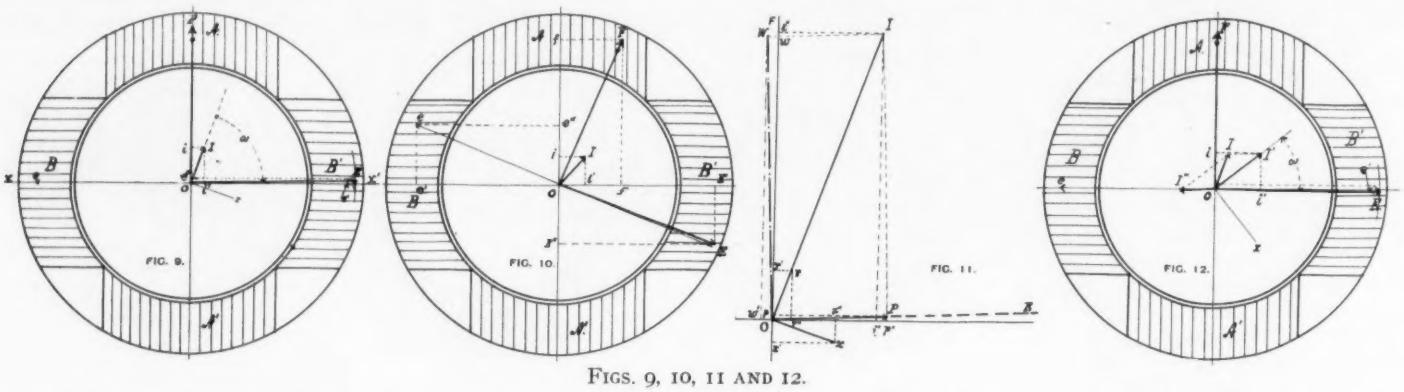
It is often assumed that the reactance e. m. f. is developed by lines of force that leak out of the field and armature promiscuously in every direction and regardless of phase relation, the only condition being that they must not pass through the coils of the opposite member, that is, the field leakage flux must not pass through the armature conductors, if it does it ceases to be a leakage flux, and in the same way the armature leakage must not pass through any of the turns of the field coils. At the proper place it will be shown that only the lines of force that pass through circuits that are mainly in air can be counted in this category, for if the path is through iron the flux will be in phase with the main flux and, therefore, not with the current; hence the induction will not be in quadrature with the current.

Diagrams such as shown in Figs. 4, 5 and 6 serve very well to illustrate the inductive action of the rotating field upon the field coils, but if we were to attempt to depict the reactance effect we would complicate the diagram to such a degree as to impair its usefulness, and, furthermore, as the magnitude of the leakage flux would have to be represented by a very small circle, the lines drawn to separate the action in the two sets of coils would be so close together that the relation could not be well defined. In order that we may be able to determine the magnitude of the currents flowing in the field coils it is necessary to represent not only the c. e. m. f. and the reactance e. m. f., but also the impressed e. m. f., and this can be more clearly shown by means of regular polar diagrams. Fig. 9

shows such a diagram drawn to represent the conditions when the magnetization is in the vertical position, and when the armature current is zero; that is, when the armature is running in synchronism with the field. Looking at this figure, the first thing we observe is that if the flux is in the direction *O F* the current that develops it must be in the *B B'* coils, while in the *A A'* coils the current must be zero. This would necessarily be the value of the currents if the magnetization and the current were in phase, but as the magnetization lags behind the current, there will be a small current in the *A A'* coils; that is, as the magnetization developed by these coils has reached the zero value, the current will be slightly in advance of the zero value. For the present let us assume that the current and magnetization are in time or phase with each other, then the current in the *B B'* coils will be at the maximum value and in the *A A'* coils at the zero value. The c. e. m. f. induced in the *B B'* coils will be zero, as shown in Fig. 4, while that induced in the *A A'* coils will be at the maximum value. Now, to keep the current in these latter coils down to zero it is necessary that the impressed e. m. f. be of the same value as the c. e. m. f. Since the armature is doing no work, the energy absorbed by the field coils is very small, hence the greater portion of the impressed e. m. f. must be balanced by the c. e. m. f., and since with the position of the flux shown in Fig. 9 the c. e. m. f. is at the maximum value in the *A A'* coils, it follows that in these coils the impressed e. m. f. is also very near its maximum value. As the currents in the two sets of coils are in quadrature with each other, if the impressed e. m. f. in the *A A'* coils is near the maximum, that in the *B B'* coils will be near the zero value, and we thus have the remarkable fact that the strongest current flows in the coils in which the impressed e. m. f. is the lowest. How this comes about can be made clear by an examination of the construction of the diagram Fig. 9.

The line *O F* represents the magnetic flux in magnitude and direction and the line *O I* represents the magnetizing current, also in magnitude and direction, or phase. If the magnetic circuit were in air, *O F* and *O I* would be in phase with each other, but as the circuit is mainly composed of iron, *O F* lags behind *O I*, as a certain amount of time is required for the metal to rise to the magnetic condition corresponding to the magnetizing force of the current. Now the current *O I* is what we may call an imaginary current; that is, this line does not represent the current flowing in either set of coils, but is the resultant of these two. If the angular advance of the current, ahead of the magnetization, is as great as shown in the diagram, then the current actually flowing in the *B B'* coils will be equal to *O i* and the current in the *A A'* coils will be *O i'*. The flux *O F* will induce an e. m. f. equal to *O e* and in the direction of line *X X'*, which is the line upon which the current in the *A A'* coils is shown. This induction, which is a c. e. m. f., acts wholly upon the *A A'* coils. The reactance e. m. f. will be in quadrature with the current, and therefore will be in advance of the c. e. m. f. as much as the current is in advance of the magnetization; that is, it will be in a direction opposite to the line *O x*. Now, the e. m. f. impressed upon the primary current must be sufficient to balance the c. e. m. f., the reactance e. m. f. and the e. m. f. required to drive the current through the coils. To balance the c. e. m. f. we must have an e. m. f. *O e'* equal to *O e*, but in the opposite direction. From the point *e'* we draw a line parallel with the current *O I* and another line parallel with the reactance e. m. f. *O x*. On these two lines we lay off distances equal to the two e. m. fs. and then construct a parallelogram the diagonal of which ends at the point *E*; thus *O E* is the impressed e. m. f. in magnitude and in phase. The e. m. f. required to overcome the resistance of the coils as well as the reactance e. m. f. and the impressed e. m. f. are not in phase with either the line *X X'* or the vertical, hence these lines simply represent the resultants of the resistance and reactance e. m. fs. and the impressed e. m. f. acting in the two sets of coils. It will be seen that the impressed e. m. f. is very nearly in line with *O e'*, therefore the impressed e. m. f. acting in the *A A'* coils is very near the maximum value, while that acting in the *B B'* coils is, as shown, almost at the zero value, being equal to the line *O e''*.

If we assume the lines *O F*, *O I*, *O E* and *O e* to be rigidly connected with each other and to be revolved around the centre *O*, then their projections when in any particular position upon the vertical and horizontal axis will give the values of the current, the impressed e. m. f., the c. e. m. f. and the proportion of the magnetic flux contributed by each circuit for that position. Thus in Fig. 10 the magnetization is shown rotated about 20 degrees from the vertical position, and *O F* is made up of the two components, *O f* supplied by the *B B'* coils, and *O f'* supplied by the *A A'*. The c. e. m. f. *O e* now acts on both sets of coils, developing an e. m. f. *O e'* in the *A A'* coils and *O e''* in the *B B'* coils. The magnetizing current *O I* is the resultant of the current *O i* flowing in the *B B'* coils and the current *O i'* flowing in the *A A'* coils. The impressed e. m. f. *O E* is the resultant of the e. m. f. *O E'* acting in the *A' A* coils and *O E''* acting in the *B B'* coils. The line *O F* which represents the magnetic flux may be considered as real, as it actually shows the position of the rotating field and also its magnitude, but the other lines represent imaginary resultants of the e. m. fs. acting in the two sets of coils, and also of the currents and the c. e. m. fs.; the real values of these e. m. fs. and currents are shown on the vertical and horizontal axis, the former indicating the values in the *B B'* coils and the latter the values in the *A A'* coils.



FIGS. 9, 10, 11 AND 12.

In Fig. 9 the resultants of the resistance and the reactance e. m. fs. are drawn at the end of the e. m. f. *O e'*, and they are of such diminutive size that their components in the two sets of coils cannot be clearly shown. By transferring them to the centre of the diagram and showing this on an enlarged scale the components can be also drawn. This is done in Fig. 11, which is an enlarged view of the centre of Fig. 9. In this figure, *O I* represents the magnetizing current resultant in phase and magnitude, but *O F* and *O E* represent the phase of the magnetization and impressed e. m. f. only, and not their magnitude. The current *O I* not being in phase with the e. m. f. *O E* is not wholly an energy current, but is the resultant of an energy component *O P* and a wattless component *O W*. The resultant of the resistance e. m. fs. is *O r*, which is composed of the components *O r'* acting in the *B B'* coils, and *O r''* acting in the *A A'* coils. The resultant of the reactance e. m. f. is *O x*, and its components *O r'* acting in the *B B'* coils, and *O r''* acting in the *A A'* coils. The magnetizing current *O I* is the resultant of the current *O i* flowing in the *B B'* coils and the current *O i'* flowing in the *A A'* coils. The energy component of *O I*, which is *O P*, is itself a resultant of a large energy current flowing in the *A A'* coils and a very small energy current flowing in the *B B'* coils. The wattless current *O W* is also the resultant of a large wattless current flowing in the *B B'* coils and a small wattless current flowing in the *A A'* coils. Thus we see that while the magnetizing current flowing in the *B B'* coils is the largest it is almost wholly wattless, while the magnetizing component in the *A A'* coils, although smaller, is almost entirely an energy current. In the *B B'* coils the magnetizing component is the sum of the wattless and energy components; that is, *O i* is the sum of *O W* and *O P*, but the component of the magnetizing current in the *A A'* coils is the difference between the energy and the wattless currents flowing in these coils. This is due

to the fact that with the flux in the vertical position the wattless current $O\ W'$ in the $A\ A'$ coils flows in opposition to the energy current, hence the latter is reduced by an amount equal to the value of the former.

The wattless component of the magnetizing current is almost in phase with the magnetization; that is, with the relation between resistance and reactance e. m. fs., shown in the figure. If these two e. m. fs. were of such magnitude that their resulant would lie in the direction of the horizontal axis, then the wattless current would be exactly in phase with the magnetization. The impressed e. m. f. E, however, can be in quadrature with the magnetization, or it can be above the horizontal line, as in Fig. 11, or below it, its exact position depending wholly upon the relation between the resistance and the reactance e. m. fs.

When there is no current flowing in the armature, the total amount of energy applied to the field coils is equal to the impressed e. m. f. multiplied by the energy current $O\ P$. Of this energy an amount equal to the current $O\ I$ multiplied by the resistance e. m. f. $O\ r$ is absorbed by the resistance of the field coils, and the balance is required to overcome the hysteresis loss. The energy applied through the $A\ A'$ coils is equal to the product of the component of the impressed e. m. f. in these coils by the component of the energy current $O\ P$, and as these two components are nearly equal to the resultants themselves, we have the fact that when the magnetization is vertical, and thus developed almost wholly by the action of the current flowing in the $B\ B'$ coils, the greater portion of the total amount of energy supplied to the motor field coils is received through the $A\ A'$ circuit. That this is the case can be more clearly seen by observing that the energy appearing in the $B\ B'$ coils is equal to the product of the energy component $O\ p$ and the impressed e. m. f. component which, although not shown in Fig. 11, is only a little greater than $O\ p$. Now, the product of these two small quantities is but an insignificant fraction of the product of the components of current and e. m. f. in the $A\ A'$ coils. From this it is shown that the magnetization is produced by a current that is almost wholly wattless, while the energy current is supplied to overcome the hysteresis and resistance losses.

When the relation between the resistance and reactance is such that the resultant of their e. m. fs. lies along the horizontal line, that is, at right angles with the flux, then the wattless component of the magnetizing current will be in phase with the magnetization, and the current in the $B\ B'$ coils will be wholly wattless, when the flux is in the vertical position. If the reactance is greater, so that the resultant of the resistance and reactance e. m. fs. lies below the horizontal line, making a greater angle with the flux than 90 degrees, then the wattless component of the magnetizing current will lead the magnetization, and its component in the $B\ B'$ coils will be greater than that of the magnetizing current, while the energy current in the $A\ A'$ coils will be smaller than the component of the magnetizing current in the same coils, and the deficiency will be made up by a wattless component.

When the armature rotates in synchronism with the flux, its conductors are not cut by the lines of force, and therefore no e. m. f. is induced therein. If the armature is held stationary, the flux will cut through its conductors at the same rate as through the field wires, and therefore the e. m. f. induced in them will be the same per conductor as in the field coils. The armature resistance is very low in comparison with that of the field coils, hence a mere fraction of the e. m. f. induced in the latter, i. e., a fraction of the c. e. m. f. $O\ e$, is sufficient to develop as strong a current as is necessary to raise the power output of the motor to the maximum value. If the current flowing in the armature is small that in the field coils will be but slightly greater than the magnetizing current $O\ I$ of the preceding figures, but as the armature current increases, the field current will increase, and when the latter reaches the greatest strength that the wire can carry without heating to an excessive degree, the maximum capacity of the motor is attained; that is, providing the armature is properly proportioned so that its conductors may carry the corresponding current without overheating. The strength of the primary, or field current, is dependent upon the strength of the secondary, or armature current, and also upon its phase relation. The phase of the secondary current is dependent upon the resistance of its coils, the speed of the armature, and also upon the magnitude of the secondary leakage flux, shown in Fig. 8.

In order that the relation between the e. m. fs. and currents may be shown, when a current flows in the armature coils, we will make use of polar diagrams, taking the same type as were used to illustrate the inductive action of the primary currents upon the field coils. This type of diagram helps to make the matter clear from the fact that the ring upon which the $A\ A'$ and $B\ B'$ coils are drawn represents the field of a two-phase motor of the bipolar type, and the inner circle represents the outer surface of the armature, thus enabling us to more readily conceive the actions of the currents and e. m. fs. in the coils.

In Fig. 12 the rotating field $O\ F$ is taken in the vertical position and of the same magnitude as in Fig. 9, and the magnetizing current $O\ I$ is also of the same magnitude and in the same angular position with reference to the field $O\ F$. The c. e. m. f. $O\ e$ is balanced by the direct e. m. f. $O\ e'$. The resistance e. m. f. is no longer in phase with $O\ I$, for now the actual resultant of the field currents is $O\ I'$, hence the resistance e. m. f. must be taken in this direction, and the e. m. f. required to balance the reactance e. m. f. must be in the direction of $O\ x$ 90 degrees ahead of $O\ I'$. As $O\ I'$ is greater than $O\ I$ the resistance and reactance e. m. fs. are greater than when there was no armature current, hence the parallelogram formed at the end of $O\ e'$ must be larger, and as $O\ I'$ and $O\ x$ are advanced in position relative to Fig. 9 the resultant of the resistance and reactance e. m. fs. runs to a point on the line E below the horizontal axis, hence the impressed e. m. f. $O\ E$ forms an angle with the magnetization $O\ F$ slightly greater than 90 degrees. The current flowing in the $A\ A'$ coils now is $O\ i'$ and that in the $B\ B'$ coils is $O\ i$, and although the former is the larger of the two, the field is still in the direction of $O\ F$. This condition of things is due to the fact that the magnetization developed by the armature current offsets the effect of the current flowing in the $A\ A'$ coils, and with the values of currents shown in this diagram, it also offsets, slightly, the action of the current in the $B\ B'$ coils.

Fig. 13 shows the primary and secondary currents about twice as great as in the previous figure. In this case the primary current, in addition to being considerably increased, is further in advance of $O\ I$ than in Fig. 12. The line of the reactance e. m. f. is also further advanced, and in consequence of the increase in current strength, the resistance and reactance e. m. fs. are greater, hence the parallelogram constructed at the end of $O\ e'$ is larger than in Fig. 12, and the impressed e. m. f. $O\ E$ is advanced further ahead of the horizontal axis. The current $O\ i$ flowing in the $B\ B'$ coils is now very much smaller than the current $O\ i'$ flowing in the $A\ A'$ coils, but still the rotating flux $O\ F$ is in the vertical position and of the standard magnitude. This greater difference between the current in the A and B coils is compensated for by the increased secondary current, which completely neutralizes the magnetizing effect of the current in the $A\ A'$ coils, and largely offsets the action of the current in the $B\ B'$ coils. In this diagram the secondary current lag is of such magnitude as to render it feasible to indicate the magnitude of the secondary reactance e. m. f. which is in the direction $O\ x'$ The resistance e. m. f. in the secondary is in the direction of the secondary current, and by assuming a proper scale we can take the line $O\ I''$ to represent the resistance e. m. f. of the secondary as well as the secondary current. If this line $O\ I''$ represents the secondary resistance e. m. f., then the line $O\ x''$ will represent the secondary reactance e. m. f.

In Fig. 14, as will be seen, the currents $O\ i$ and $O\ i'$ are very much larger than $O\ I$, and the first is smaller, relatively to the second, than is the case in Fig. 13. The secondary current is also very large, and acts principally to offset the magnetizing effect of the primary, so that the net resulting field may not be displaced from the vertical position nor varied in magnitude. The position of the primary is advanced, and this, in connection with the fact that the resistance and reactance e. m. fs. are increased, causes the primary impressed e. m. f. to be in a phase further advanced than in Figs. 12 or 13. As will be noticed, the secondary reactance is also increased much more in proportion than the secondary resistance e. m. f.

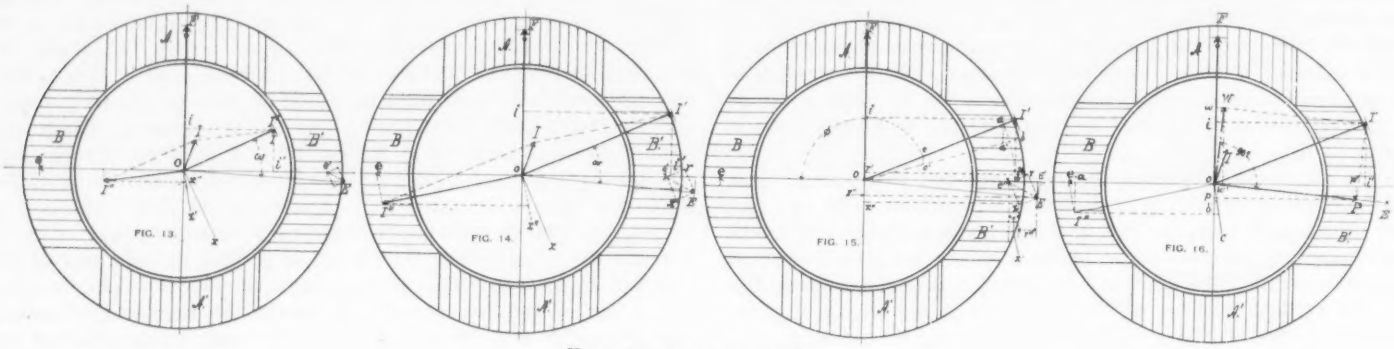
The character of the currents flowing in the field coils and the magnitude of the various e. m. fs. for the strength of the current, shown in Fig. 14, can be well illustrated by means of Fig. 15. Since the rotating field is in the vertical position and has the magnitude $O\ F$, the counter e. m. f. is of the magnitude $O\ e$ and at the angle $\emptyset$ equal 90 degrees, and lags behind the magnetization. To overcome this c. e. m. f. a direct e. m. f. of equal value, $O\ e'$, must be impressed upon the circuits. As the resistance e. m. f. is equal to $e'\ r$ and parallel with $O\ I'$, and the reactance e. m. f. is equal to $e'\ x$, the resultant or impedance e. m. f. is $e'\ E$ and the total primary impressed e. m. f. is $O\ E$; that is, this is the resultant of the primary impressed e. m. fs. acting in both circuits. It is also the maximum

value of each primary e. m. f. The primary current flowing in the *B B'* coils is *O i*, and the e. m. f. required to force it through the coils is equal to *O r'*. The reactance e. m. f. acting in the *B B'* coils is equal to *O x''*. The c. e. m. f. acting in the *B B'* coils is zero, hence there are three e. m. fs. to be considered, one the resistance e. m. f. equal to *O r'*, one the reactance e. m. f. equal to *O x''*, and one the impressed e. m. f. equal to *O E''*. As seen, the current flows in opposition to the impressed e. m. f., but this is the direction of the reactance e. m. f., for it must be remembered that the e. m. f. *e' x* is not the reactance e. m. f., but the direct e. m. f. necessary to balance it, and which is applied in the opposite direction. The direction of the reactance is from *x* to *e'* and not from *e'* to *x*. It will be noticed that the reactance e. m. f. is equal to the resistance e. m. f. and the impressed e. m. f. acting in the *B B'* coils, hence the current *O i'*, in these coils, flows under the influence of the reactance e. m. f. at this particular instant.

In the *A A'* coils the current is *O i'* and the impressed e. m. f. is *O E'*. The c. e. m. f. is *O e'* and the reactance e. m. f. is equal to the line *x'*, so that the net e. m. f. acting in these coils is the portion of the impressed e. m. f. equal to the line *r''*, and this is just sufficient to force the current *O i'* through the coils; for since it requires the e. m. f. *e' r*, equal to line *I' b*, to force a current, *O I'*, through the coils, it will require the e. m. f. *r*, equal to line *a a'*, to force the current *O i'* equal to *O a*, through the coils.

In Fig. 16 the energy and wattless currents are shown for the phase of primary current resultant corresponding to Fig. 15. The energy component is *O P*, and the wattless component is *O W*. These components are themselves the resultants of the same type of current in the two sets of coils, so that *O P* is the resultant of *O p'*, the energy current in the *A A'* coils, and *O p* the same type of current in the *B B'* coils. In the same way *O W* is the resultant of *O w'* and *O w*, the wattless currents in the *B B'* and *A A'* coils, respectively. The energy current in the *A A'* coils is smaller than the component of *O I'* in the same coils, and in the *B B'* coils it is also smaller and at the same time flows in the opposite direction. The wattless current in these coils is larger than the component of *O I'*, and the excess is equal to the energy current; thus the wattless current extinguishes the energy current and leaves a surplus equal to the component of the current *O I'*.

The wattless resultant of the wattless currents flowing in the two sets of coils is so nearly in line with the magnetization that it may be so regarded, but the resultant of the energy currents in the two circuits is nearly at right angles to the magnetization, hence the former acts to magnetize the field while the latter does not. This statement at a first glance appears paradoxical, since it infers that current of one kind can magnetize and current of another cannot, but the true explanation is that the energy currents are counteracted in their magnetizing effect by the secondary current. The secondary current, however, is not wholly an energy current, but also has its wattless component. This fact is shown in Fig. 16, where the energy component of *O a* is in phase with the secondary impressed e. m. f., which is in quadrature with the rotating field *O F* and the wattless component *O b*. From this diagram it will be seen that the wattless current in the armature acts in opposition to the wattless current in the field coils in its magnetizing effect. If a parallelogram is constructed with the primary and secondary wattless currents *O W* and *O b* as adjacent sides, the resultant so obtained will run in a direction slightly in advance of *O W* and have a length somewhat greater than the magnetizing current *O I*. If the primary and secondary currents are reduced, and the wattless components are then compared, it will be found that their resultant will come nearer and nearer to the value of *O I* as the secondary is reduced. Now the reason why the resultant of the primary and secondary wattless currents is greater than the magnetizing current *O I* is that the primary and secondary energy components do not entirely neutralize each other in their magnetizing effects. It will be seen in Fig. 16 that the action of the primary energy component *O P* is nearly in opposition to the action of the secondary energy component *O a*, but not quite; therefore, their combined effect as determined by the principles of parallelogram of forces will be in the direction of *O c*, and its magnitude will be *O p*. Now if the resultant of the primary and secondary wattless currents is combined with this resultant of the effect of the primary and secondary energy currents we will get the magnetizing currents *O I*. The resultant *O p* of the energy components of the primary and secondary currents will swing into phase with *O i'* when the resultant of the primary impressed e. m. fs. is in quadrature with the flux O F, and with this phase relation between primary current and e. m. f. the component of the primary wattless currents will swing into phase with the magnetization. Under these conditions the resultant of the primary and secondary wattless currents will be in the direction *O F* and will be simply the difference between *O i* and *O b* and this will be equal to the projection of *O I* upon *O F*, while the resultant of the primary and secondary energy currents which will lie in the direction of *O i'* will be the horizontal projection of *O I* upon *O i'*.



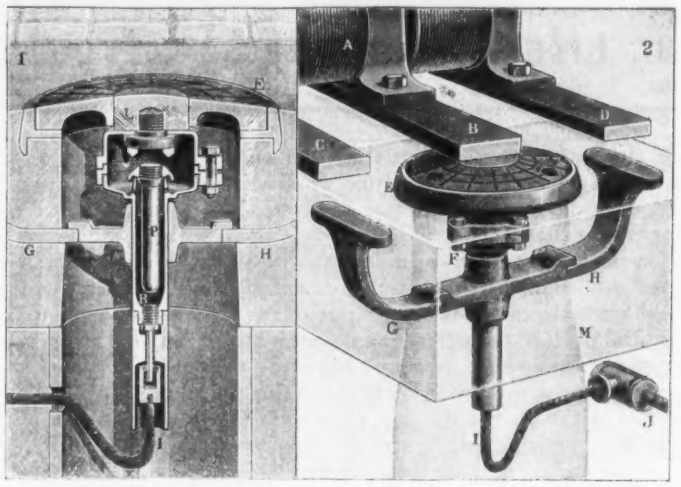
FIGS. 13, 14, 15 AND 16.

A New Electrical Pulp Industry for Niagara.

There is building on the lands of the Niagara Falls Power Company at Niagara Falls, a new manufacturing establishment in which pulp for papermakers' use will be manufactured from flax straw. The name of the controlling company is the French-Hickman Fibre Company, Ltd. It is an English concern, and B. F. French, of Boston, is the managing director. Stanton Day, of Niagara Falls, will be the local manager. Great effort is being directed to the buildings in order that they may be enclosed before bad weather sets in. The plant has a frontage of 210 feet on Elizabeth street, and it will have two wings, one of which will have a length of 384 feet and be 56 feet wide, while the other will have a length of 276 feet and be 54 feet wide, the two buildings to be connected by a building 100 feet long and 48 feet wide. The plot of ground leased from the Niagara Falls Power Company comprises five acres. Five hundred electrical horse-power has also been contracted for, and in addition to this the company will install a steam plant of 500-hp. The capital of the company is $750,000. The output capacity of the plant will at the start be 10 tons a day, but arrangements are such that this can be increased very rapidly. The half stuffs, as the product is called by the trade, will be supplied in sheets clear of all foreign matter, bleached and unbleached, at the start, but finally it is the company's intention to furnish their product only in the bleached form. The product of the factory, it is understood, is already spoken for by mills engaged in making a high grade of paper, such as fine writing papers, etc. The raw material for the plant will come from North Dakota, where, at Fargo, a branch of the business is located. Heretofore flax straw has been a worthless product to the Western farmers, only the heads of the straw and seeds having been used up to this time. But the new industry, the process of which it is stated has been fully tested, and the product tested in mills in the United States and England, will result in the flax straw having a commercial value to the farmers. The plant in Fargo will treat the raw material to a certain extent before it is shipped to Niagara Falls, and in this way freight rates between the two plants will be economized. The Niagara plant will be nicely located for the distribution of the half-stuffs to the consuming plants.

The Diatto Electric Railway System.

From a description in *La Nature* of the first application of the Diatto surface-contact system, recently made, at Tours, we reproduce the following excellent illustrations of the mechanism of the surface-contact device. When completed the electric railway system now being installed at Tours will comprise a system of urban lines seven miles long and suburban lines to Luynes, St. Avertin and Vouvray. The Diatto system will be used in the city streets and the overhead trolley beyond the city limits. The feeders are cables laid directly



DIATTO ELECTRIC RAILWAY SYSTEM.

on the earth in trenches, and taps are taken every 16 feet to contact boxes.

The contact boxes are placed 16 feet apart, and are contained in a block of asphaltum, which latter is laid over a pipe, into which the central hollow portion of the block opens. The top of the contact box, E, is of non-magnetic metal, and has in its centre a soft iron plug, L, through which current passes to a central bar under the car, and thence to the motor, the return being through the track rails. In this plug is a bolt having on its head a cup-shaped piece of carbon, which makes contact with a conical piece of carbon on a floating iron cylinder, *P*, when the latter is raised in a manner which will be described later. About the middle of the box are cast iron wings, G and H, on which rests a cross piece carrying an ebonite cup filled with mercury. This mercury by means of a copper plug, R, in the bottom of the ebonite cup and a copper rod, makes connection with the mercury in another and smaller cup beneath, which latter is connected to the feeder cable by one of the taps above referred to.

On the bars, B, C and D, carried by the car are mounted horizontal electromagnets, A, which give a north polarity to the middle or contact bar, B, and south polarity to the outer bars, C and D. A magnetic circuit is thus established, on one side through the bar, B, the iron floating cylinder, P, the wing, G, and the bar, C; and a similar circuit on the other side through the wing, H. Each electromagnet carries two separate windings. Through one of these passes the current which actuates the motor, and through the other current passes from a small battery of accumulators giving 5 amperes at 30 volts, the latter being constantly in circuit.

At the moment of starting, the battery current magnetizes the bars, which raises the floating iron cylinder, P, and the latter then, through the carbon contacts, closes the motor circuit. The current then passes from the central plug, L, through the bar, B, to the motor, and thence to the rails. The contact boxes by this means are in connection with the feeders only at the precise moment when a bar of a car passes over a box, and the circuit is broken as soon as the car passes on. But the boxes are placed at such intervals with relation to the length of the contact bar that the circuit of the motor itself is never broken, the car being thus continuously supplied with current.

CURRENT NEWS AND NOTES.

PRIVATE PLANT STREET LIGHTING.—Owners of private electric lighting plants in St. Paul are to be given an opportunity to bid on the furnishing of street lights in their immediate vicinity. The idea is to introduce the element of competition. There is only one large electric-lighting plant in the city, and there is no inducement to capital to build another, as the city charter does not permit of the making of a lighting contract to extend beyond one year. As a consequence, there has been no opposition. It is intended to divide the city into lighting districts, and to consider bids for each district, as also for the city as a whole, the latter with the crude idea, probably, that the threat of competition may bring the lighting company to terms. The plant in the city's library building is effective enough to light one district, and there are several other private plants not worked to their full capacity, sufficient to throw the whole electric district open to competition.

STATUS OF ELECTRICAL WORKERS.—R. W. Sherman, of Rochester, N. Y., secretary of the Electrical Workers of America, was the first witness before the Industrial Commission at Washington on Sept. 22. Most of the members were linemen and wiremen, he said, and the dues of his organization were 60 cents per month. There was $100 death benefit. There had been thirteen strikes in the organization in eighteen months; of these the organization had won eleven, had compromised one, and one was still on. The organization did not include more than 2 per cent. of the electrical workers. As a rule the workers had steady employment. There was much extra work for which extra pay was obtained. The average pay was about $3 per day. His organization believed in compulsory arbitration. In a strike at Cleveland the union had offered to appeal the issue to the State Board of Arbitration, but the company refused. Compulsory arbitration, in his opinion, should carry with it power of enforcing acceptance of the decree by both parties.

TROLLEY POLITICS IN DETROIT.—It is announced on authority of Elliott G. Stevenson, member of the late Street Railway Commission appointed to purchase the street railways of Detroit for the city, that the entire Pingree plan of municipal ownership and three-cent fares is dead and permanently abandoned. Mr. Stevenson made this statement on returning from a conference in New York with R. T. Wilson, principal owner of the roads; Tom L. Johnson, and others interested. The reason given is that Mr. Wilson refused to tie up the property with another option, and that he also increased the price of the roads from approximately $15,000,000 cash to $17,000,000—the increase, it is claimed, being justified by the increase of net receipts under the five-cent rate of fare. This increase from six-for-a-quarter fares, which is within the companies' franchise rights, was made just following the municipal ownership agitation of last spring. The three-cent fare issues being eliminated from the local political situation, it is regarded as altogether improbable that Gov. Pingree will consent to be a candidate for mayor this fall. Mr. Wilson will not extend his option beyond Nov. 1 to the Municipal Railway Company formed by Pingree and his friends to take over the roads for the city.

Propagation of Electric Energy.

To the Editors of Electrical World and Engineer:

Sirs:—Lodge, in "Modern Views of Electricity," p. 103, says: "Prof. Poynting has shown that on the principles developed by Maxwell * * * the battery emits its energy not to the wire direct but to the surrounding medium (dielectric), which, disturbed and strained, propagates the strain on from point to point till it reaches the wire and is dissipated."

If this correctly states the physical actions occurring in a battery and closed circuit in a dielectric, then it would seem as if a very considerable effect should be produced by surrounding or inclosing a battery with a conducting shell well connected to earth. The energy emanating from the battery and starting through the dielectric medium, meeting this inclosing conducting surface, should be in such large measure led away from the wire of the battery circuit (which lies outside the inclosing shell) as to notably diminish the "current" in this external circuit.

To try this experimentally, I had Mr. F. T. Cole, a student in the Physical Laboratory of Pennsylvania State College, inclose a gravity cell in a covered tin vessel, the circuit wires passing out to a very sensitive Thomson mirror galvanometer. The tin vessel was earthed. Repeated trials, with same resistance in circuit, with the cell inclosed and not inclosed, gave no determinable difference in the "current" in the external circuit. Thinking that the tin might be too thin to much affect radiations of the rate produced by the battery, a

casing was made of a heavy cast-iron cylinder and plates 1 or 2 cm. thick) with holes drilled for circuit wires. This also gave no determinable effect.

Varying the experiment, a "wireless" telegraphy receiver was inserted in the earth wire attached to the iron casing. No delicacy of adjustment possibly gave the slightest indication of any energy falling upon the casing and its earth wire.

Of course, the negative result of this last form of trial was fully to be expected. If the energy of the battery is given to the surrounding dielectric it is quite certainly by means of radiations of atomic or molecular frequencies, and, therefore, far out of the range to which the apparatus could respond.

I. THORNTON OSMOND.

STATE COLLEGE, PA.

DIGEST
OF
CURRENT ELECTRICAL LITERATURE.

By CARL HERING.

DYNAMOS, MOTORS AND TRANSFORMERS.

Iron Wire on Armatures for Small Motors.—A short article pointing out that small electric motors, as usually made, have a very low fly-wheel power, and, therefore, are often unsatisfactory for driving certain classes of machines. He recommends putting a heavier weight into the armature, and suggests doing this by using iron wire for the conductors. As the tendency is now to build slow-speed motors, with only a single reduction gear, often four poles instead of two are used, and as the usual voltage is 220 or 440, the sizes of the armature conductors come out exceedingly small for copper wire; substituting iron wire gets over all mechanical difficulties, because for equal conductivity the wire is about two and a half times the diameter of copper wire. Another advantage is the reduction of the air gaps and the resulting further advantage that the pole pieces may be brought much nearer together without undue magnetic leakage. If iron wire is used, the total weight of the armature is considerably greater, which increases the fly-wheel power.—Lond. *Elec. Rev.*, Sept. 8.

Multicircuit Arc Dynamo.—A complete description of the principle of operation of the Brush machine of this type, pointing out the fact that the division of the circuits into a number of parts intercalated in series between the separate sources of e. m. f., cuts down greatly the maximum difference of potential of the circuit. The advantages and disadvantages are discussed, and tests are cited, showing the tendency to break down the insulation, particularly of underground wires, when the line is accidentally opened at any point.—*Amer. Elec.*, Sept.

The Short-Circuit Curve of Alternating Current Generators.—ROTHERT.—The first two parts of what promises to be a very long article based on his diagram of the ampere windings and magnetic fluxes of an alternator. He concludes from this diagram that if an alternator is short circuited, the primary field ampere windings are equal to the sum of the armature ampere windings and the equivalent of the armature stray field in ampere windings. If the abscissas give the primary field current and the ordinates the armature current, the short circuit curve starts as a straight line from near the origin, and bends up slightly for very high currents; as long as the equivalent of the flux produced by the armature in ampere windings is small compared with the primary field ampere windings the short circuit curve is independent of the speed. This curve is nearly independent of the air space; the influence of the form of the teeth and pole pieces, upon this curve is very small. These conclusions, drawn for three-phase current generators, hold also for single-phase alternators, the influence of the armature stray field being, however, somewhat larger in this case. He gives some analytical calculations as to single-phase alternators and discusses the use of the short circuit curve for the calculation of the armature reaction. Under certain conditions, which are correct in general, the following rule is given: If the primary current for no load and for the given e. m. f. is combined with that for short circuit for the given current, the primary current for full load for any power factor is obtained. He then begins to give an account of tests made with five alternators during three years.—*Elek. Zeit.*, Aug. 31, Sept. 7.

Rotary Converter.—ADAMS.—A short illustrated description of a 300-kw Westinghouse two-phase rotary converter producing direct currents at 220 and 110 volts. The method of starting by means of a special motor built directly on the main armature shaft at the alternating current end, is described. It often becomes necessary to vary the direct current voltage which cannot be done satisfactorily by changing the field of the rotary, but is accomplished in this case by an alternating current regulator, which is simply an arrangement whereby a variable ratio of the windings of the primary to the secondary of the transformers may be obtained. The method of obtaining two voltages is extremely simple; the voltage across the direct current brushes is 220; a neutral wire is run from the middle point of the winding of each transformer, and thus the direct current voltage between either the positive or the negative terminal and this neutral point in the alternating circuit is 110. To prevent pumping or surging, copper rings are placed about the ends of the pole pieces of the rotary, with projecting sheaths covering the horns, and slightly embedded in the face of the pole piece itself; these sheaths take up the armature reaction, eddy currents being set up in them, and thus prevent the variation of the field strength.—*Eng. Year Book*, Univ. of Minn., 1899.

Operating Dynamos in Parallel.—Some illustrated remarks on running shunt and compound wound dynamos in parallel. When a dynamo reverses its polarity, shut down the dynamo, raise the brushes from the commutator and close the main switch; then gradually cut out all the resistance of the field rheostat; after 15 or 20 seconds insert all the field resistance in circuit again and open the main switch as slowly as possible, prolonging the flash that follows the blades; then put the brushes down and start up again; if the machine persists in coming up wrong after this treatment, repeat the operation, keeping the machine in circuit with its brushes raised for a period of a minute or two. Before switching a dynamo in circuit with another, the e. m. f. of the former should be brought up, not to the same e. m. f. as that of the brushes of the working machine, but to the e. m. f. of the bus bars. A similar precaution should be taken when a dynamo running in multiple with other dynamos is to be shut down.—*Power*, September.

REFERENCES.

Speed and Efficiency of Shunt-Wound Motors.—Two communications on the question of what alterations should be made to obtain the requisite speed and efficiency, if a shunt-wound motor specified to run 800 revolutions per minute with an efficiency of 90 per cent., gives when tested only 85 per cent. with 650 revolutions. The different reasons of the speed being low, and the various losses which diminish the efficiency, are discussed, and the necessary alterations to correct the faults, are described. In the second communication it is said that the probable fault may be a wrong value of the shunt resistance, which must have a certain ratio to the armature resistance for the required efficiency.—Lond. *Elec. Eng.*, Sept. 8.

Theory of the Voltage Equalizer.—MONTEL.—A short article giving the theory of what he calls an equalizer, by which he means an apparatus consisting of a coil over an iron core, the ends of which coil are connected to a source of alternating current, while different parts of the coil are connected to various branch circuits where the current is used. He limits himself to only two such branch circuits and to the case in which there is no self-induction in them; also to the case in which the power will be about the same in each.—*L'Eclairage Elec.*, Aug. 26.

Synchronizing of Alternators.—GARDNER and HOWGRAVE-GRAHAM.—The first part of an illustrated student's paper read before the Institution of Electrical Engineers. After explaining why it is impossible to run alternators in series, unless they are rigidly connected to the same shaft, they discuss the parallel running of alternators, which is possible on account of their reversibility or ability to act as synchronous motors. A description of methods of synchronizing alternators is begun.—Lond. *Elec. Rev.*, Sept. 8.

Surging of Parallel Connected Generators.—GUILLAUME.—A long abstract of the article of Kapp, noticed in the Digest March 11. To this he adds the application of the formulas to the 40-pole alternators in one of the Paris stations. Also some formulas from an article on electromagnetic synchronization by Cornu, showing some agreement with the Kapp formulas.—*L'Eclairage Elec.*, Aug. 26.

Commutation.—An elementary illustrated article on commutation and how it is effected in ironclad armatures.—*The Engineer*, Sept. 1.

LIGHTS AND LIGHTING.

REFERENCES.

Incandescent Lamp.—A brief illustrated description of the so-called nitrate lamp noticed in the Digest Aug. 5.—*L'Eclairage Elec.*, Aug. 5.

POWER.

Electric Ploughing.—A short note stating that electricity has been recently tried on the Royal farms in Prussia for drawing ploughs, in which an electric motor is used to drive the winding drums, mounted on a motor wagon, which is also driven electrically The cost is said to range from $11.50 to nearly $15 per acre, while the cost of steam ploughing was considerably over $20. These numbers refer to ploughing heavy soil to a depth of 8 to 10 in.; the speed of the plough was about 3 feet per second.—Lond. *Elec. Eng.*, Sept. 8.

Electrical Energy in Belgium.—GERARD.—An abstract of a paper read before the Society of Electrical Engineers of the Institute Montefiore, discussing the future of the industry in Belgium, where there is a total lack of water power. Although not favored by nature with water powers, Belgium has developed large electrical installations, using more especially continuous current. For the future he urges that the energy of the vast quantities of gases escaping from the blast furnaces should be more fully utilized. A horse-power-hour can be obtained from 4 cubic meters of that gas, which corresponds to 90,000 kw-hours for the blast furnaces in Belgium.—*L'Ind. Elec.*, Aug. 28.

REFERENCES.

Electric Power Distribution Over Mine Districts.—HILLE.—A paper read before the Canadian Mining Institute, pointing out the advantages of utilizing the large water powers available in Canada for electric transmission and distribution among a greater number of mines situated in close proximity. He describes a number of different types of electric drills.—*El'ty*, Sept. 20.

Transmission and Distribution by Alternating Currents.—LEBLANC.—The fourth and fifth parts of his long serial (see Digest, April 29). The present portions are on the properties of induction machines, on the excitation of non-synchronous motors, and on redressing transformers.—*L'Eclairage Elec.*, Aug. 5, 12, 19, 26.

Elevators.—RICHARD.—In this portion of his long serial on the mechanical applications of electricity, he gives brief but well illustrated descriptions of electric elevators and cranes, taken from patent specifications.—*L'Eclairage Elec.*, Aug. 19.

Efficiency.—WALKER.—A reprint of the article noticed in the Digest, Sept. 23.—*El'ty*, Sept. 20.

TRACTION.

Cast-Weld Rail Joint in France.—An extract from a report to the International Tramway Union concerning the application of the Falk joint in Europe. The general cost in France is $3.60 to $4.00 per joint, including royalty. On a line from Lyon to Oullins the cost of maintenance fell from $1,000 per year and per km to about $20, after this joint was used. About 32,000 of these joints have been made on French lines. Some figures for the resistance are given, but they are not sufficiently complete.—*L'Eclairage Elec.*, Aug. 12.

Trolley Head.—An illustration, with a short description, of a trolley head designed by Towle. The chief difference from the ordinary one is that the flanges of the trolley wheel are replaced by fixed guides, which is said to reduce the size and weight of the head by nearly 50 per cent., and this reduces the tension which is required.—Lond. *Elec.*, Sept. 8.

Generation of Power for Electric Traction.—SCOTT.—In the conclusion of his illustrated serial (Digest, Sept. 9) he describes the machinery installed at the generating station at Bradford. The dynamos give 750 amperes at 500 to 550 volts, a considerable overload having been sustained at various times. As the interchangeability of the generators in a combined lighting and traction plant is very important, each machine is provided with a change over switch which is described and illustrated.—Lond. *Elec. Rev.*, Sept. 8.

Electric Cabs in Berlin.—An illustrated description of the first electric cab in Berlin. Electricity seems to be the only available power for automobile cabs in Berlin as the use of explosive motors is forbidden by the authorities. As the cabs must have certain measurements prescribed by the authorities, old cabs formerly used with horses were changed into electric, the Hellmann system being used. The two motors are placed under the seat of the driver; each weighs 110 lbs. and drives one of the rear wheels by means of a chain and a flexible shaft. Each motor alone can drive the cab at reduced speed. At 85 volts the speed is 1100 revolutions per minute, each thus giving 2-hp. The accumulators are placed under the cab in a special case which can be replaced by a new one, in two to three minutes. The battery of four cells has a capacity of 60 to 70 ampere hours and is sufficient for a trip of 19 to 26 miles. The braking can be accomplished electrically as well as mechanically. The cab has a weight of 2750 lbs. without passengers; it will seat five persons besides the driver.—*Elek. Zeit.*, Sept. 7.

Electric Traction.—GREATOREX.—The conclusions of his long serial (Digest, Sept. 23). Short descriptions are given of four English trolley lines, of the Blackpool conduit system before conversion, of the lines of Birmingham, Hanover, Paris, where the accumulator system is used, of the combined overhead and accumulator system at Paris, and of the combined overhead trolley and conduit system at Paris.—Lond. *Elec. Eng.*, Sept. 8.

Mountain Railway in India.—An illustrated description of the proposed Kashmir electric railway referred to in the Digest, Aug. 5.—Lond. *Elec. Rev.*, Sept. 8.

Sheffield Tramways.—A well illustrated description of this municipal tramway referred to in the Digest, Sept. 23.—Lond. *Elec. Rev.*, Sept. 8.

Burgdorf-Thun Railway.—The first part of a well illustrated description of this three-phase railway, which was referred to in the Digest, Sept. 9.—Lond. *Elec.*, Sept. 8.

REFERENCES.

Egypt.—An illustrated description of the electric railroad from Cairo to the Pyramids, which was referred to in the Digest, Aug. 5 and Sept. 23.—*Elec. Rev.*, Sept. 20.

Grenoble.—GOUTARD.—An abstract of a long report on the proposed extensions of the tramway lines in Grenoble, France, the overhead trolley system at 550 volts being used.—*L'Ind. Elec.*, Aug. 25.

Combined Trolley, Conduit and Accumulator Railway in Berlin.—PERISSE.—A short description of this installation, which was referred to in the Digest, Aug. 19.—*L'Elec.*, Sept. 9.

French Electric Fire Engine.—A brief illustrated description of the one noticed in the Digest, Sept. 23.—*West Elec.*, Sept. 16.

The Automobile Club of France.—MANN.—An illustrated account of the development of this club since it was founded in 1895, and its work, which was essentially the organization of a series of expositions and competitive tests of automobiles.—*Elec. Rev.*, Sept. 13.

INSTALLATIONS, SYSTEMS AND APPLIANCES.

REFERENCES.

Gas Engine Central Station.—A short illustrated description of the re-equipment of the station at Bradford, Pa. All the generators are driven by gas engines, which are four in number.—*Amer. Elec.*, Sept.

Long Distance Transmission.—Another description of the small station at Auburn (see Digest last week) to work in parallel with another station five miles away, both supplying a transmission line 29 miles long to Sacramento. A complete diagram of the circuits of both generating stations and the power station is given. The wheels are of the double nozzle impulse type, working at 300-r.p.m. and coupled to a 500-kw generator; this delivers two-phase currents, which are transformed up to 3000 volts three-phase. The governing is accomplished by deflecting hoods manipulated by hand.—*Amer. Elec.*, Sept.

WIRES, WIRING AND CONDUITS.

Aluminium for Conductors.—In a note emanating from the General Electric Company, of Berlin, the advantages of aluminium for conductors are briefly discussed. Bare aluminium wire is furnished down to a diameter of 0.05 inches at 30 cents per pound, so that the price is 35 to 45 per cent. lower than that of bare copper wire of equal resistance. Aluminium is especially recommended for trolley

wire. They claim to have found a perfect method of joining at the factory, which enables them to supply continuous wire in any length up to a weight of 660 pounds. For other splices they supply aluminium connecting sleeves and a liquid solder with which to fill them.—*Elek. Anz.*, Aug. 24.

This note is discussed editorially in the Lond. *Elec.* More details should be given concerning the method of joining, the resistance of the joints, and the constancy of the resistance with time. The contact resistance at the trolley is referred to; pure aluminium, when exposed to the air, acquires a superficial film of oxide, which would oppose considerable resistance between the wire and the trolley. The wind and snow pressure should not be forgotten.—Lond. *Elec.*, Sept. 8.

Variation of Insulation of Air Cables with Temperature.—DEFLACELLIERE.—Descriptions and results of what appears to have been a long and carefully made test, said to be the first of its kind, to measure the variation of the insulation resistance of paper cables, when the temperature varies. The measurements were made between 16 and 80° C., and the results are given in tables and curves. The curves have the general shape of an equilateral hyperbola and are quite regular. He also gives the values and curves of the relation at any temperature, to that at 24°, for a number of different French cables, presumably made with gutta percha; this ratio falls much more rapidly for gutta percha than for paper cables, and the latter are therefore less affected by variations of temperature.—*Annal. Telegraphique*, 25, p. 97; abstracted at some length in *L'Eclairage Elec.*, Aug. 19.

REFERENCES.

Interior Wiring.—KNOX.—A continuation of the serial taking up the subject of interior conduits and discussing the recently amended underwriter's rules and some of the more novel forms of conduits, such as the Greenfield flexible steel tube.—*Amer. Elec.*, Sept.

ELECTRO-PHYSICS AND MAGNETISM.

Explosive Effect of Electrical Discharges.—TROWBRIDGE AND HOWE.—An experimental investigation, made with two high tension transformer or Planté rheostatic machines, giving discharges of 125 and 180 to 200 cm. They were connected to a battery of 10,000 cells, thus giving voltages up to 3,000,000. Various methods of measurement were tried. On account of the great tension, all galvanometric and electrometric means had to be abandoned, and the so-called electric thermometer was finally adopted, consisting of a hermetically closed glass tube provided with a manometer gauge, the electric discharge passing through the tube by means of a fine wire or by a spark gap. The results of the investigation are summed up as follows: The explosive effect of electrical discharges is due to an electrostatic effect, rather than to a heat effect. There is a strong analogy between the terminal conditions existing in electrical discharges and those of the electrodes of an ordinary voltaic cell. "The electrical density on the terminals of a condenser is proportional to the strength of the current, which the charging battery is capable of producing." The electrostatic field diminishing much more rapidly with the distance than the electromagnetic field, doubtless has its energy consumed in molecular movements.—*Phil. Mag.*, Sept.

Pressure Within the Electric Spark.—HASCHEK AND MACHE.—An investigation of the phenomenon observed by Warren de la Rue that a stream of sparks passing through a partial vacuum produces a sudden but only temporary increase of the pressure, which cannot be due to the heat of the spark. Having obtained an idea of the actual dimensions of the spark by photography, they measured the increase of pressure per unit surface of the vacuum tube by a specially constructed manometer, calculated the total increase of pressure and reduced it to the surface of the spark to obtain the pressure in the spark itself, which was found to increase with the energy, the pressure of the gas and the sparking distance; it was higher between electrodes of carbon than of iron, zinc or other metals. It is attributable to the particles projected from the electrodes, which according to Schuster may attain velocities of 12 miles per second.—*Wied. Ann.*, No. 8; abstracted in Lond. *Elec.*, Sept. 8.

Genesis of the Electric Spark.—WALTER.—Experimental researches to show the successive stages of the genesis of an electric spark by means of photographs. The electric spark does not find its way across the dielectric all at once, but feels its way, so to speak, by several brush discharges proceeding from both electrodes, which eventually unite.—*Wied. Ann.*, No. 8; abstracted in Lond. *Elec.*, Sept. 8.

Contact Theory.—MAJORANA.—Three illustrated papers describing series of interesting experiments. After a concise discussion of the fundamental experiment of Volta and of the contact theory, he refers briefly to the views of Lodge and Exner, claiming that some of the experiments made by the latter and quoted by him in support of his chemical theory, support the contact theory, if rightly interpreted. He then describes some of his own experiments which illustrate the theory of contact and which are mainly founded on the extension of Volta's principle of producing free charges by the approach or separation of different metals. A drum of wood or ebonite capable of rotation, is provided on its cylindrical surface with two insulated semi-cylindrical metallic plates, one of zinc and one of copper, each covering slightly less than 180° of the circumference of the drum. The two parts of a commutator, mounted on the shaft of the drum, are connected each to one of the metallic plates. The drum is enclosed within two semi-cylindrical armatures, similar to the two plates on the surface of the drum, and concentric with the drum, one of zinc and one of copper, both being connected metallically by an external conductor. When the drum rotates, the zinc of the drum approaches the fixed copper armature in one-half revolution, and the copper of the drum approaches the fixed zinc armature, a current therefore goes from the copper to the zinc; in the next half-revolution the zinc of the drum is separated from the fixed copper armature and the copper of the drum from the fixed zinc armature and at the same time the positions of the collectors are changed, so that a continuous though very small current is obtained. The calculated and observed currents agreed approximately. He describes a modified form of this apparatus which gives a six or seven times greater current. In the third paper he describes some devices for observing the attractions which must result from Volta's theory that two unlike metals in metallic communication are at different potentials. The simplest and best device is the following. A quartz fibre of 0.01 millimeter diameter, or even less, and about 10 centimeter long, is silvered over the whole of its surface; the upper end, after having been plated with copper for a short distance, is soldered to an insulated wire of stiff copper; the lower end is slightly inclined to a square plate of brightly polished zinc of 1 centimeter a side, which can be made to approach the quartz thread by means of a finely threaded screw. By means of a microscope, the lower end of the quartz fibre and its image in the bright zinc plate are observed. If the fibre and the plate are connected together and earthed by a metal wire, and the zinc plate is approached to the fibre, a sudden movement of the fibre towards the zinc is noticed when the end of the fibre and its image are about 0.2 millimeter apart, the quartz fibre being then attracted to the zinc. He then describes a slightly modified form of this experiment, allowing the e. m. f. of contact of two different metals to be measured. From his measurements he finds the following series: Aluminum + 1.1 volt, zinc + 0.9 volt, iron + 0.5 volt, brass + 0.45 volt, copper + 0.4 volt, silver 0, gold — 0.2 volt. This method of measurement being a zero method, is capable of considerable precision, and can be carried out fairly rapidly.—*Rend. della R. Acad. dei Lincei*, VIII, 1, p. 188, 255, 302; translated in full in *Phil. Mag.*, September.

Röntgen Rays.—ROLLINS.—In a continuation of his long illustrated serial, he discusses the influences of temperature on the permeability of Röntgen rays. The reason why cooling the outside of the vacuum tube increases the penetrating power of the light, he claims, is that the vacuum is kept higher, therefore the velocity of the cathode stream is greater, resulting in shorter waves. He discusses the effect of the degree of the vacuum on the temperature of the target and the use of electrolytic interrupters for exciting vacuum tubes, for which purpose the double focus tube is a better type than the single focus tube.—*Elec. Rev.*, Sept. 20.

Effect of the Nature of the Electric Source on the Spectrum of a Discharge.—PEROT AND FABRAY.—An abstract of a French Academy paper on the influence of the nature of the electric source upon the spectrum of a discharge through a Michelson tube filled with the vapor of cadmium. The electric sources they used were a Rhumkorff coil with a condenser in shunt; a Tesla apparatus; a transformer giving a sinusoidal alternating current; a battery of 500 small accumulators. The last method gave especially fine spectral lines and enabled the interference phenomenon to be easily produced.—*L'Eclairage Elec.*, June 24.

Conductivity of Metallic Powders.—SUNDORPH.—A description of an experiment. On a horizontal glass plate there are two paral-

iel metallic pieces several millimeters apart; across the interval finely pulverized iron or nickel is placed; after establishing conductivity by means of electric waves, the greater part of the filings are lifted off with a weak magnet, leaving in tact those through which the current is passing.—*Wied. Ann.*, 68, p. 594; abstracted briefly in *L'Eclairage Elec.*, Aug. 12.

Cathode and Lenard Rays.—GOLDSTEIN.—An article on the structure of cathode rays and the nature of Lenard rays. When a beam of rays strikes a solid wall, diffuse rays are produced which can penetrate to a certain distance into the wall; if the thickness of the latter is greater than this distance, only diffuse cathode rays are produced; but if it is less, then the rays which traverse it are Lenard rays; the latter are said to be nothing more than cathode rays which have been diffusely reflected, as he showed in 1881.—*Wied. Ann.*, 67, p. 84; abstracted at considerable length and with illustrations in *L'Eclairage Elec.*, Aug. 12.

Absorption in a Magnetic Field.—RIGHI.—An investigation of the "converse Zeeman effect." The gas introduced into the magnetic field was hyponitrous acid, or preferably sodium vapor. The acid shows a large number of absorption lines. One of them, viewed with a nicol, is broadened in a magnetic field to twice its original breadth, and shows nebulous edges. Two lines in the neighborhood show no effect whatever. The lines are very variously effected.—*Nuovo Cimento*, July; abstracted in Lond. *Elec.*, Sept. 8.

Magnetic Hysteresis of Cobalt.—FLEMING, ASHTON and TOMLINSON.—An account of an experimental investigation made with a cobalt ring of supposed fairly pure commercial cobalt. The ring was submitted to a complete set of magnetic tests, with the usual ballistic galvanometer method; the results are given in tables and diagrams. The most interesting result is that Steinmetz's law, namely, that the hystereses loss varies as the one-sixth power of the maximum flux density, which was found by Steinmetz for iron and steels of various composition and by Kennelly for nickel, holds good also for cobalt.—*Phil. Mag.*, Sept.

Magnetic Susceptibility of Liquid Oxygen.—FLEMING AND DEWAR.—An abstract of a Royal Society paper. They found the magnetic permeability of liquid oxygen to be 1.0041; by a different method they had previously obtained 1.0027. The measurement of magnetic susceptibility at low temperatures is discussed. The susceptibility of manganous sulphate at 25° is to that at —180° in the inverse ratio of the absolute temperatures. Other experiments with manganous sulphate indicate that the paramagnetic susceptibility varies directly as the density.—Lond. *Elec. Eng.*, Sept. 8.

REFERENCES.

Duration of Cathodic Phenomena.—WIEDEMANN.—Descriptions of apparatus to show that the sudden fall of potential which is produced at the cathode has not an appreciable duration.—*Wied. Ann.*, 67. p. 714; abstracted in *L'Eclairage Elec.*, Aug. 12.

Discharge Tubes.—WIEDEMANN AND SCHMIDT.—Descriptions of electric and thermic measurements of discharge tubes.—*Wied. Ann.*, 66. p. 304; abstracted with illustrations in *L'Eclairage Elec.*, Aug. 12.

Zeeman Effect.—REESE.—A short account of an experimental investigation, confined to a comparatively exhaustive study of the spectrum iron between wave lengths 3400 and 4500, and of the spectra of magnesium, cadmium and zinc. The results are compared with those of Preston.—*Johns Hopkins Univ. Circular*, June, p. 59; *Phil. Mag.*, Sept.

Calculating the Electrostatic Capacity of Lines.—BREISIG.—A French translation in abstract of the article noticed in the Digest, Dec. 10, 1898.—*L'Eclairage Elec.*, June 24.

Distribution of Magnetic Induction in a Long Iron Bar.—LAMB.—An experimental investigation of the distribution, when the rod was subjected to various magnetizing forces. The results are given in form of tables and diagrams. The following data are given: A curve of magnetization of the bar as determined by means of a search-coal at its center; a series of curves at various definite magnetizing forces, showing the distribution of induction in each case; a magnetization curve of the bar when made into a ring, so that the induction is the same at every cross section.—*Phil. Mag.*, Sept.

Mechanism of Magnetization.—CHABOT.—A short illustrated description of a "possible mechanism of magnetization."—*Phil Mag.*, Sept.

Terrestrial Magnetism.—The September issue of *Terres. Mag.* contains the following articles: A review of Le Cadet's Treatise on atmospheric electricity, by McAdie; a short illustrated article in French, by Moreaux on the periodicity of the pertubations of the horizontal magnetic needle, as observed at Parc Saint Maur from 1883 to '97; two long articles in German by Wild, on the possibility of erecting complete magnetic observatories all overground in one building, and on a complete overground magnetic observatory; a short well illustrated article by Griffith on the influence of the earth upon the field of a bar-magnet; and a biography of Prof. Neumayr with portrait.—*Terres. Mag.*, September.

Electric Properties of Wood.—MAZZOTTO.—Three articles on the double electric refraction of wood, on the Maxwell relation between the electric constants of deal, and on its electric conductivity. The experiments were undertaken to verify whether the Maxwell relation is applicable to the constants of wood.—*Rend. Accad. dei Lincei*, Aug. 1, 15, Sept. 5, 1897; abstracted in *L'Eclairage Elec.*, Aug. 19.

ELECTRO-CHEMISTRY AND BATTERIES.

Bleaching Wood Pulp.—NAVARRE.—An extract from his article in *L'Ind. Electrochimique*, describing the Corbin electrolyzer for making bleaching liquid. It consists of a series of compartments separated by thin sheets of platinum, one side of each of which acts as anode for one compartment and the other as cathode for the other; only the end plates are connected to the circuits and the compartments are thus all connected in series. A solution of common salt at 2.5° B. is used for the electrolyte. A number of advantages are claimed over the Hermite apparatus, one of which is that relatively high voltages, such as are used for lighting, can be applied directly. The cells in the installation at Lancey contain 13 plates and operate with 120 volts and 150 amperes; the daily production is equivalent to 150 kg of choride of calcium; the efficiency is claimed to be better than in the Hermite apparatus. In a factory in which 3000 kg of the pulp is treated per day, the annual saving over the usual method will depend greatly on the cost of the horse-power, and will be about $80 when the horse-power costs $60 per year, or $4700 when the horse-power costs $10 per year; the first cost of the electrolyzer and accessories in such an installation is given as $12,000, and it is, therefore, thought that in many cases the economy would be quite appreciable.—*L'Eclairage Elec., Aug.* 5.

REFERENCES.

Theory of Dissociation.—VON OETTINGEN.—The conclusion of his paper mentioned in the Digest, July 8, giving a short account of Kohlrausch's law for the velocities of ions, of Ostwald's law for the dependency of the electric conductivity of a solution on its concentration, of Nernst's theory of the e. m. f. of a cell consisting of different concentrations of the same solution with reversible electrodes, and of Ostweld's method, with drop electrodes, to measure single potential differences.—Lond. *Elec. Eng.*, Sept. 8.

Theory of Grotthus Applied to a Simple Voltaic Cell.—COOPER.—An illustrated article of an elementary character.—Lond. *Elec.*, Sept. 8.

Photographic Study of Electrolytic Cells.—RAMSEY.—A short illustrated account of an investigation in which Toepler's "Schlieren-apparat" was used for the study of electrolytic action, an electrolytic cell, through which a current flows, being placed between the two slits of the apparatus. Six good photographs obtained in this way are reprinted.—*Phys. Rev.*, Sept.

Velocity of Ions.—CAMPETTI, LUSSANA.—An article by the former on the influence of temperature on the velocity of ions, and discussed by the latter. The results of the two experimenters are so different that they cannot be accepted as conclusive.—*Nuovo Cimento*, 6, p. 410 and 414; abstracted in *L'Eclairage Elec.*, Aug. 26.

Velocity of Migration of Ions.—KOHLRAUSCH.—An article on the migration of electric ions in dilute aqueous solutions below 1-10 normal.—*Wied. Ann.*, 66, p. 785; abstracted in *L'Eclairage Elec.*, Aug. 26.

Capacity of Polarization.—SCOTT.—Descriptions of experiments with thin membranes of various metals.—*Wied. Ann.*, 67, p. 388; abstracted in *L'Eclairage Elec.*, Aug. 26.

UNITS, MEASUREMENTS AND INSTRUMENTS.

Electrical Units.—Brief abstracts of the recent article by Blondel (ELEC. WORLD, July 29) followed by some comments. It is thought that the proposition of Blondel is a very acceptable one; the only criticisms made are that he changes the adopted meaning of the prefixes micro and mega, which are also used with other units not electrical, like the megadyne; also that he does not suggest any prefixes for the sixth and twelfth powers; but both of these objections are thought to be of little importance, and are easy to overcome. It is also thought that the system will give rise to some confusion for a long time, and preference is, therefore, expressed for the Amer-

ican system, that is, to give new names to the C. G. S. units, as all confusion will thus be avoided. If after the adoption of these new words and units they are not acceptable, and if the old system continues to be used, the temporary use of the new one will have done no harm.—*L'Eclairage Elec.*, Aug. 5.

Method of Measuring Resistances.—Weber.—A description of a new method in which the material, the resistance of which is to be measured, can be used in the form of plates or thick cylinders. Either a magnet is made to vibrate over a disc made of the material or a cylinder of it is made to vibrate in a magnetic field. The damping produced by the induced currents forms a measure of the conductivity, the logarithmic decrement being directly proportional to it. The accuracy obtained is claimed to be 7 per cent. in the case of alloys and amalgams. A somewhat modified method consists in observing the deflection of the body in a rotating field, but this is not quite as satisfactory, owing to the shifting of the zero; it is suitable for electrolytes as well as for metals.—*Wied. Ann.*, No. 8; abstracted, in Lond. *Elec.*, Sept. 8.

Permeameter.—Poole.—A description of a simple machine suitable for shop service, for measuring the permeability of iron; it is a small dynamo the field yoke of which consists of the sample of iron to be tested; the armature when driven at a constant speed gives a voltage proportional to the number of lines of force threading through the specimen; knowing this and the number of ampere turns in the field exciting coil, the permeability can be determined.—*Amer. Elec.*, Sept.

Work of the German Reichsanstalt.—The conclusion of the report noiticed in the Digest, Sept. 23. A summary is given of the 460 strong current instruments which were tested. The e. m. f. of standard Weston cells was tested for different temperatures between 0° and 30° C.; the differences in e. m. f. were only about 0.0001 volt, but no law for the dependency of the e. m. f. on the temperature could be found. In the low current department 30 tests of the specific resistance and the temperature coefficient of various materials, and 132 tests of single resistances were made; 73 of the instruments tested were exported, 38 to the United States. High resistances without capacity and induction, consisting of very small films of platinum alloys on porcelain, as devised by Kundt, were tested, a very small increase of resistance being found during 1.5 years; an attempt will shortly be made to introduce them. In the magnetic department 35 samples of steel and iron were tested. An investigation of the measurement of hysteresis losses by different methods, was begun.—*Elek. Zeit.*, Sept. 7.

Direct Determination of the Absolute Kilohm.—Guillet.—The first parts of a very long article on the application of a zero method for measuring absolute units of high resistances and on the results which he obtained in recent researches. In the first part he gives a historical summary in which he reviews all the various methods for determining the ohm, and a table of all the values which were found. The method which he used seems to be based on one suggested by Lippmann in which a battery furnishes currents for two circuits simultaneously; these currents flow in opposite directions through the two coils of a differential galvanometer; the current in one of these circuits is a continuous one, while in the second it is an interrupted one, formed by the discharges of a condenser charged by the same battery; the galvanometer needle will remain at zero if the quantities of electricity in the two circuits are equal during a certain time.—*L'Eclairage Elec.*, Aug. 5, 12, 26, Sept. 2.

Rheostats.—Vallee.—An article calculating analytically the lengths and volumes of the wires of two rheostats for the same resistance, current and increase of temperature, but with different specific resistances; the formulas are not in very convenient forms. For the same price of the metal, that metal which has the highest specific resistance is the better. Ferro-nickel is cheaper and less voluminous than German silver, on account of its higher fusion point. The general result is that the choice of rheostat wire depends upon the price of the metal, its resistance against oxidizing, specific resistance, increase of melting point and ductility.—*L'Elec.*, Sept. 9.

REFERENCES.

Recent Progress in Oscillographs.—Blondel.—The conclusion of his long, well illustrated article, the first part of which was noticed in the Digest, May 6. He describes bifilar oscillographs, the improvements devised by Dudell, and those devised by himself. He also gives a short analytical theory and promises a complete theory in another article.—*L'Ind. Elec.*, Aug. 25.

Properties of Condensers of High Capacity.—Tobler.—An account of a series of tests made with the Muirhead condensers of 10 microfarads, containing subdivision of 1, 2, 3, 5 microfarads. The influence of the time of charging, of the potential of charging, the insulation, the quantity absorbed and the values of the subdivisions were investigated, and the results proved to be very satisfactory.—*Elek. Zeit.*, Sept. 7.

Electric and Magnetic Units.—Schreber.—A somewhat longer abstract, with some of the equations of the article noticed in the Digest Sept. 23.—*L'Eclairage Elec.*, Aug. 12.

Measuring the Insulation of Accumulators.—Liebenow.—A long abstract of the article noticed in the Digest June 10.—*L'Eclairage Elec.*, Aug. 19.

Apparatus for Measuring the Light from Arc Lamps.—Laporte.—A long abstract with the illustrations, of the article noticed in the Digest July 15 and Sept. 9.—*L'Eclairage Elec.*, Aug. 26.

Loop Testing for Cable Faults.—Wright.—An illustrated article discussing some points in the theory and practice of those methods which consist in the formation of a loop of the cable under test. He brings out certain modifications and gives the favorable conditions for such testing.—Lond. *Elec. Eng.*, Sept. 8.

The Mershon Compensator.—A description of the principle of operation and details of construction of this ingenious device for compensating voltmeters for the ohmic and inductive drop of feeders, transformers or both.—*Amer. Elec.*, Sept.

Internal Resistance of Standard Cells.—Cohen.—A long French abstract of the article mentioned in the Digest, Aug. 26.—*L'Eclairage Elec.*, June 24.

Cradle Dynamometer.—McKissick.—A short description of a simple form of dynamometer built especially for testing 5-hp induction motors.—*Amer. Elec.*, Sept.

Telegraphy, Telephony and Signals.

Telegraphy with Discontinuous Lines.—De Nerville.—An illustrated description of the Smith and Granville system which is in use between the Fastnett Lighthouse and the Irish coast; the lighthouse is situated on a rocky island where the waves break so violently that all the cables which have been laid there have been destroyed, and for this reason the present system was used; it was originally installed in 1895 and has been operated without interruption since 1897. An insulated cable seven miles in length starts from the shore and terminates 100 feet from the island, at a depth of about 20 meters; this is rigidly anchored to a large copper "mushroom" to which the end of the conductor is attached; it has the double object of an anchor and a good conductor connecting the end of the cable with the sea. A second circuit runs from one side of the island nearest the end of the cable, to the opposite side, in the same direction as the cable, as though it were a prolongation of it; both ends of this second circuit are grounded in the ocean. An intermittent current sent from the shore end through the cable and into the sea, will start electric waves from the end of the cable as a centre; these will create differences of potential at the two ends of the second line on the island, thus causing currents which pass through the recording instrument. Inversely a current passed through the second circuit will cause currents to be generated in the first. The installation on the island has ten large Leclanche cells and the current is about 1.5 amperes which generates a current of about 15 hundredths of a milliampere in the long cable, and the receiving apparatus on the shore must therefore be a very sensitive one. As both ends of the cable are also grounded, there are earth currents produced in it which must be guarded against. —*Annal. Telegraphique*, 25, p. 5; abstracted with illustrations in *L'Eclairage Elec.*, Aug. 19.

Telegraphs and Telephones in Argentina.—Tennille.—A short statistical article. The telegraphs are owned and operated either by the government, provinces, states, railroad companies, or by private companies; but between these varied interests there exists a general tariff, of which the national line sets the controlling price, and this general schedule has been extended into the republics of Uruguay, Paraguay and Bolivia. All the telephone lines in Argentina are owned by private companies, the present number of instruments in use being 24,800.—*West. Elec.*, Sept. 16.

REFERENCES.

Composite Telegraphy and Telephony.—Webb.—A complete analysis of the different systems of simultaneously telephoning and telegraphing over the same wires, with cuts showing the circuits. Instructions are given for the construction of the condenser and coils necessary for such a system.—*Amer. Elec.*, Sept.

Independent Telephone Exchange.—An illustrated description of

the independent exchange at Lafayette, Ind., accompanied with cuts showing the details of the switchboard and the circuits of the transfer system used. The board is fitted for 1100 wires.—*Amer. Elec.*, Sept.

Duplex Telephony on German Interurban Lines.—SCHWENSKY.—A long abstract with illustrations of the article noticed in the Digest Jan. 14.—*L'Eclairage Elec.*, Aug. 12.

MISCELLANEOUS.

Standardization.—An editorial comment on the recent report of the Amer. Inst. of E. E. The report is thought to be a very complete one, and it is hoped that the English will profit by its example. Very few comments are made; the various names for different varieties of stationary transformers are thought to be hardly necessary at present; what are called potential regulators in the report had better be termed variable-ratio transformers; the term induction-potential-regulator is considered to be incorrect for a constant current transformer such as is used in the Ferranti rectifier; the terms reactive-coil and reactance-coil are claimed to be unnecessary, as practice has sanctioned the term choking-coil. Concerning the measurements of the rise of temperature of dynamos, it is thought that the alternative, to hasten the test by running a shorter time on overload and then reducing the load to normal and maintaining it until the current becomes constant, may lead to error. Concerning the spark-gap method of measuring voltages, it is said that, except at normal pressures, electrostatic voltmeters are far preferable as so much depends on the condition of the needle points of the spark-gap.—Lond. *Elec.*, Sept. 8.

Dark Lightning.—WOOD.—A communication discussing some peculiar phenomena observed in photographs of lightning flashes. The explanation of the dark lightning shown in photographs, that it is due to photographic reversal, he considers is out of question for several reasons, and he offers the hypothesis that it may be due to a flash which appears darker than the sky behind it; there may be in the path of the dark flash dissociated molecules, radiating but feebly, and capable of taking up vibrations of periods similar to their own, coming originally from a simultaneous brighter discharge. He proposes some experiments which may lead to an explanation.—*Science*, Sept. 8.

Smelting Iron Electrically.—A note stating that according to a daily press article the Prague Iron Industry Co. (Austria) has begun experimenting with a new method of smelting iron ore electrically. Former failures are referred to, but it is thought editorially that there is no intrinsic physical difficulties in the electric smelting of iron. Reference is also made to the Stassano process consisting essentially in heating, in an arc furnace, briquettes composed of iron ore, carbon and lime made into a paste with tar. The smelting process occurs as in a blast furnace, the iron being reduced and the siliceous matter of the ore slagged off. The basis of comparison of this process with the blast furnace is the cost of power and the coke, and the opinion is expressed that it must be remarkably cheap power which will be able to displace the blast furnace as a means of smelting in localities where the cost of coke is not prohibitively high. —Lond. *Elec.*, Sept. 8.

A reprint of a somewhat longer description of the Stassano process from the London *Colliery Guardian.* The energy required for 1 ton of metal is 3000-hp hours, which amounts to an average of 18 fr. In the ordinary way of smelting, if 20 fr. is the price of a ton of coke, the fuel cost of producing 1 ton of metal is 33 fr., i. e., 15 fr. higher than in the Stassano process. The cost of the preliminary operations is said to be without doubt greater than in the other processes, but this is compensated for by the lower cost of smelting.—*Eng. and Min. Jour.*, Sept. 16, and *Elec. Rev.*, Sept. 20.

Death by Electricity.—CUNNINGHAM.—Brief extracts from a recent article describing his experiments at the Columbia University to determine whether death is the direct result of an electric shock or whether it follows as an effect of the physiological conditions superinduced by shock. He asserts that the ordinary industrial currents, and such as are used in the New York State executions, do not produce instant death and that consciousness could be restored. He claims to have established the fact that death is not caused by paralysis of the heart but by fibrillar contraction of the heart, which results in a collapse of the nervous system; death is superseded by a period of consciousness, but probably there is no sensation of pain. Death is instantaneous only when the current is so strong that the tissues are cooked and the nervous system destroyed. He has tried repeatedly but failed to electrocute frogs and a small turtle with 115 volts continuous current, as all the frogs fully recovered in a few minutes. The proper remedy is to restore quickly the circulation of not only the nervous system to keep it from dying, but also the heart, and this should be done by creating an artificial and temporary circulation of a fluid capable of sustaining the heart and the nervous system until the former has recovered sufficiently to maintain normal circulation.—*Elec. Rev.*, Sept. 13.

Magnetic Separators.—M'NEILL.—A long abstract with many of the illustrations, of the article noticed in the Digest Sept. 23.—*El'ty*, Sept. 20.

Importation of Electric Machinery into France.—Some brief statistics for the year 1897.—*West. Elec.*, Sept. 16.

REFERENCES.

Experimental Electric Furnace.—TUCKER.—An account of the valuable properties of the electric arc for furnace work, with a short history of some of the results that have been accomplished with it. A table is given of the materials that can be formed at the high temperature of the electric furnace with some of their properties; some experimental furnaces are described and illustrated.—*Amer. Elec.*, Sept.

Electric Heating.—A short description of the electric installation at a manufacturing stationer's in London. Electricity is used for heating glue pots, sealing wax, plates for letter finishing tools, rolls for blind tooling and flat plates for heating book backs.—Lond. *Elec.*, Sept. 8.

The Dynamo Manufacturers' Association.

For some time past action has been suggested on the part of the makers of dynamos and motors to bring up prices to the level required by the advance of raw materials. As none of the manufacturers cared to take the initiative, the Cutter-Hammer Manufacturing Company, of Chicago, through its general manager, Mr. H. H. Cutter, and its secretary, Mr. J. G. Hickcox, intervened, and upon their invitation a number of companies were represented at a conference held last week at the Grand Pacific Hotel, on Sept. 19 and 20. Mr. Campbell Scott, of the C & C Electric Company, presided, and Mr. C. C. Warren was chosen as secretary. Nothing definite and final was settled, but a committee of organization was appointed, which will call another meeting in New York City toward the end of October. The companies represented were: Campbell Scott, C. & C. Company; C. C. Warren, Warren Electric Manufacturing Company; James Clark, James Clark, Jr., & Co.; E. G. Bernard, E. G. Bernard & Co.; J. W. Leech, Keystone Electric Company; S. A. Sague, Akron Electric Company; W. Pimlott, Belknap Motor Company; S. L. Hadley, Commercial Electric Company; C. H. Wilmerding, Crocker-Wheeler Company; M. E. Baird, Eddy Electric Manufacturing Company; F. C. Phillips, Elwell-Parker Electric Company; F. S. Hunting, Ft. Wayne Electric Company; E. R. Harding, Holtzer-Cabot Electric Company; Walter Cary, Milwaukee Electric Company; A. O. Fox, Northern Electric Manufacturing Company; C. S. Knight, Siemens & Halske Electric Company; J. C. Hobart, Triumph Electric Company; W. S. Jones, Quaker City Electric Company; E. F. Abadie, Wagner Electric Manufacturing Company; Roth Bros., Roth Bros.; C. B. Waite, Western Electric Company; E. B. Kittle, Sprague Electric Company.

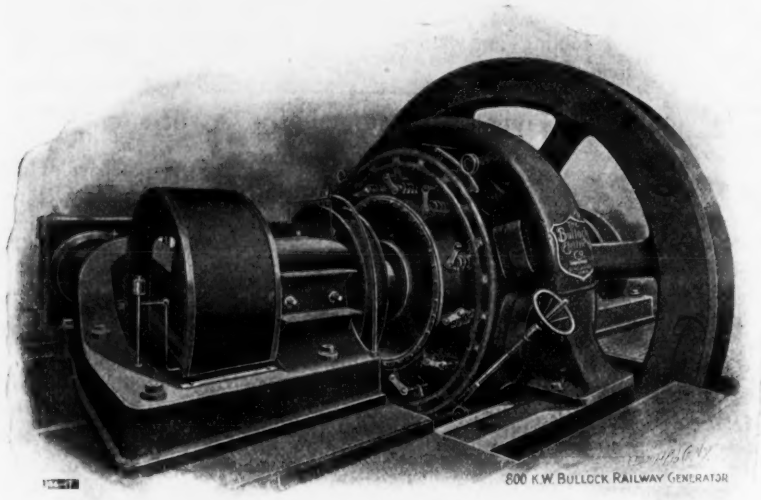
Mr. Campbell Scott has already appointed as members of his organization committee Messrs. C. S. Knight, E. G. Bernard, W. S. Jones, F. C. Phillips, and will add another member. Several companies invited were not represented at the meeting, but it is understood that they are naturally in favor of the movement to keep prices on a fair basis, commensurate with the advances in raw material, and that they will give in their written adhesion or will stand by the scale that is adopted with reference to the varying quotations in copper, steel, iron, etc. Mr. Campbell Scott since his return to New York, speaks very hopefully of the better understanding already established through this preliminary meeting, and of the bright prospects of a conservative treatment of the situation by the new organization, which it is proposed to call the Dynamo Manufacturers' Association.

BEDSTEAD INSULATOR.—Among the recent patents was one on a bedstead insulator. In the illustration a glass insulator with a wooden pin is shown, having very much the appearance of a telegraphic pin and insulator upside down. The inventor states that by the employment of his invention, all electrical connection is cut off between the bed and the ground, and the occupant of the bed thereby protected from the influence of the earth currents!

Bullock Electric Railway Generator.

The Bullock engine-type of electric railway generator shown in the accompanying engraving has been designed up to and including a capacity of 800-kw. Among the features introduced into this new type is a method for oscillating the brush holder mechanism in a direction parallel with the shaft. The movement is very slow and results in constantly changing the line of travel over the commutator face and thus removes all tendency to cut or groove the latter. The action is the same as secured by the end play of an armature in a belted generator, or that produced by the electromagnetic device sometimes used at the end of the shaft on rotary transformers, and which is recognized as a means of greatly prolonging the life of the commutator.

The pole pieces and coils may be removed without disturbing the yoke or armature, and with two of them removed, it is possible to remove one or more armature coils should repairs be necessary. The armature coils are made of continuous bars of copper without joints



RAILWAY GENERATOR.

between the commutator connections, which materially adds to the life of the machine. These coils are all thoroughly insulated, pressed and baked before being placed on the core, no additional core insulation being necessary. The armature is thoroughly ventilated by slots perpendicular to the shaft, through which the air rushes when the machine is in operation.

The machine illustrated is a 800-kw unit furnished to the Oakland Rapid Transit Company, of Oakland, Cal., and operates at 80 r. p. m., at which speed 550 volts are generated at no load. It is over-compounded for a rise of 50 volts at full load, making the full load voltage 600.

Speer Carbon Company.

One of the important industries in the electrical field is that which has just been established by the Speer Carbon Company, organized under the laws of the State of Delaware, with a capital stock of $200,000. The general manager of the new concern, Mr. J. S. Speer, is well known, having been connected with the Partridge Carbon Company, and actively engaged in the manufacture of carbon brushes for no less than nine years. Associated with Mr. Speer as officers and directors of the enterprise are Andrew Kaul, president; Lewis Streuber, vice-president; Andrew Kaul, Jr., secretary and treasurer, and B. E. Cartright and J. G. Wurtz on the board of directors.

The company have a model plant at Saint Marys, Pa. The main building is of brick, and covers about half an acre. It is quite new and barely finished. All the construction is of the most substantial kind and the various buildings and departments have been equipped throughout with the latest improved machinery.

In addition to the Speer self-lubricating motor brush, the company will make generator brushes and other carbon specialties, including electric light carbons for both open and closed arc lamps. Inquiries and correspondence are requested and will receive prompt attention.

New Type of Circuit Breaker.

A new type of circuit breakers for electric railway, factory and automobile motors is illustrated herewith, closed in Fig. 1 and open in Fig. 2. This instrument is mounted on a slate base, contained within a substantial oak box. The arm of the circuit breaker forces the lid of the box which, on opening, carries with it the coil and tripping device and allows the arcing vapor and gases to readily escape. A broad, clear space between the terminals and ample carbon contacts prevent arcing to the mechanism and terminals, which is the usual cause for the destruction of fuse boxes and other types

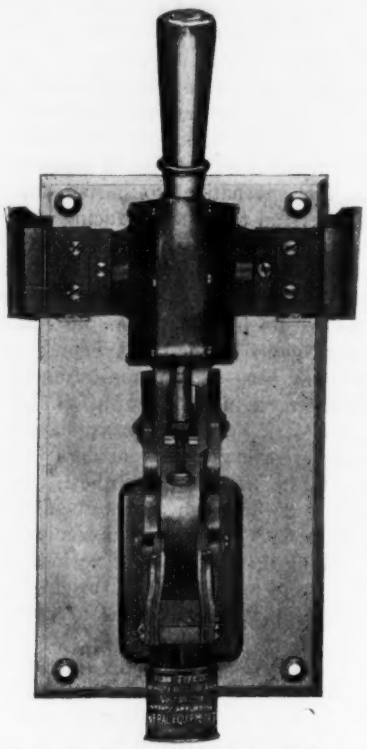


FIG. 1.—CIRCUIT BREAKER CLOSED.

of motor protective apparatus. No fuses are required, and closing the lid of the box is all that is necessary to reset the circuit breaker. The size is approximately 8 inches by 8 inches. Dust and dirt are excluded from the enclosed parts, and it is not possible to make acci-

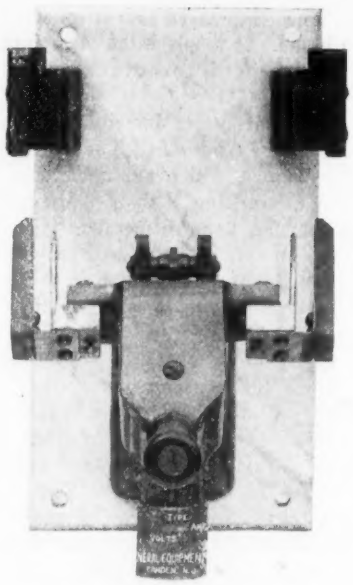


FIG. 2.—CIRCUIT BREAKER OPEN.

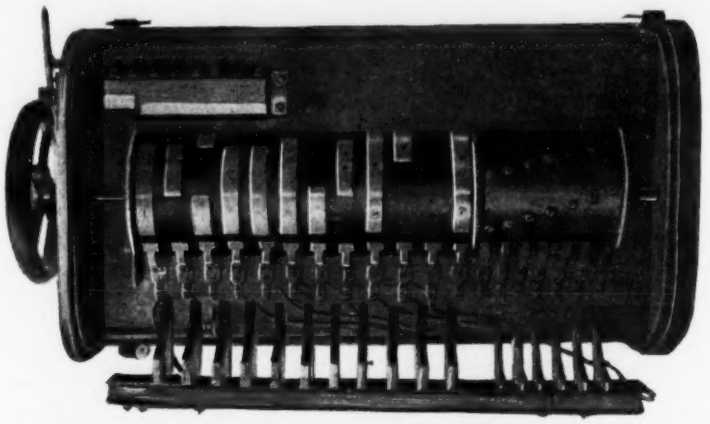
dental contact with any live part. The value of an instrument possessing these qualities is readily seen from the reduction of the cost of repairs and of power consumption that follows. The manufacturers are the General Equipment Company, of Camden, N. J.

A New Type of Electric Railway and Automobile Controller.

The controller shown in the accompanying illustration, which is the invention of Mr. John C. Henry, has been applied to 75-hp electric railway motors and recently to an eight-place theatre electric bus in the service of the Electric Vehicle Company of New York. The bus weighs 4500 pounds, and in a recent test, running backward and forward over the intersection of 114th Street and Park Avenue, New York, readings showed an average development of 2¾-hp.

We are not at liberty at present to describe the circuits of the controller, which is claimed to unite the advantages of series-multiple control, of electric braking, and of independently excited motors, and also enabling current to be thrown back into the line or battery in reducing speed or in braking.

The inventor states that for all practical purposes this controller increases the capacity of the present standard form of motor 15 per cent., and that in ordinary electric railway service, an increase of efficiency of 40 per cent. is through its employment within reach. In addition, much quicker acceleration is obtainable, an ideal braking system is provided, and without regulation cars may make the same speed in the suburbs where the voltage is low, as they do in the vicinity of the power station, thus avoiding the necessity for boosters. Cars may be run without regulation on up and down grades at about the same speed as they do on the level, and as the motors are tied together electrically, they are prevented from racing when connected in series. The motor is also protected from injurious induced currents, and the arrangement is such that the starting torque may be temporarily greatly increased without an injurious current in the armature. No resistance is used in the armature circuits, regulation being accomplished by means of the fields, which ordinarily handle but 5 or 10 per cent. of the current, and at no time over 15 per cent. of it. In stopping, the motors automatically become dynamos and send back current to the line or storage battery. Speed is automatically maintained for the reason that the strength of the fields is controlled by the line voltage; that is, when the latter is low, the weaker fields allow the armature to take more current, and consequently to run faster.



ELECTRIC RAILWAY AND AUTOMOBILE CONTROLLER ON A THEATRE BUS.

Referring to the accompanying illustration, it will be seen that instead of a handle, a wheel is used on the controller. Turning this wheel forward starts and speeds up the car or vehicle by decreasing the counter electromotive force of the motors; turning it backward increases the counter electromotive force, which increase may, on a down grade or in stopping, be carried to a point such that the motor acts as a generator, sending back current to the source, and also acting as a brake. The reversing lever is shown on the top of the case to the left and the reversing cylinder to the right, the latter controlling the field circuits. The wide contacts on the central cylinder are for the armature, field and main circuits. The smaller ones on the right part of the cylinder control the field resistance.

The Manhattan Electrical Supply Company.

Plans of importance have for some time past been in contemplation by the Manhattan Electrical Supply Company, 32 Cortlandt Street, which has increased its capital stock to $3,000,000. The company has recently made extensive purchases of real estate in New Jersey.

A New Electric Tape.

The American Commercial Rubber Company, of 21 Park Row, New York, with factories at Elizabeth, N. J., has just put upon the market a new product in the shape of the Hart electric tape. It is put up in airtight packages, is made either white or black, and each package carries the distinct trade-mark. The company states that samples which have been in the hands of customers over five months are as good as the day they were manufactured.

A Large Central Station Boiler Order.

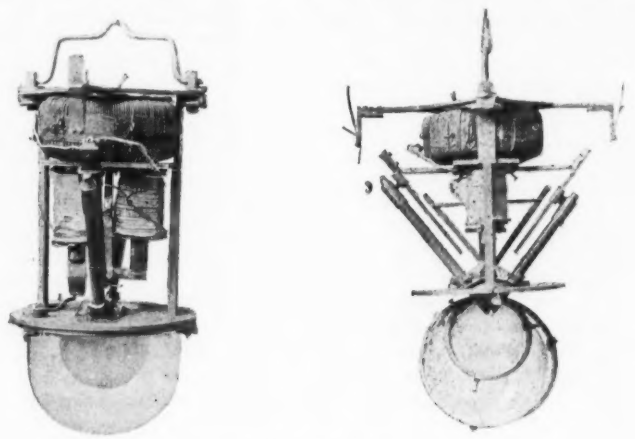
The New York Gas & Electric Light, Heat & Power Company, of this city, for its station in First Avenue, between Thirty-eighth and Thirty-ninths Streets, has just awarded to Thayer & Co., of this city, the biggest single contract for boilers ever placed in this or any other country. The capacity of this boiler plant, which is to cost fully $500,000, will be no less than 35,560-hp. Fifty-six Cahall boilers of 635-hp each have been ordered, and will be manufactured by the Aultman-Taylor Co., of Mansfield, O. The contract calls for completion of delivery inside of two years.

A Deep Sea Cable Factory.

From time to time reports have been current as to the intention of the Standard Underground Cable Company to secure such new facilities as would enable it to go into the manufacture of ocean cable, and thus meet the opportunities which are slowly but surely opening up for American products in that line. It is said that two things are sure in the near future, an American Nicaragua Canal and an American Pacific cable. In the meantime, the following special despatch has been received from Pittsburg, of Sept. 21: The Standard Underground Cable Company has purchased a site at Perth Amboy, N. J., on which to erect a plant to cost $200,000. Deep sea cables are to be made, and bids will be put in for the Hawaiian cable. Ground will be broken within four weeks, and the plant will be completed by next spring.

Cochrane Arc Lamp.

The lamp shown herewith is claimed to have a number of advantages over the ordinary arc lamp now used for street and interior lighting. One of these is that the lamp gives no shadows, on account of there being no framework under the arc. The frame, which is of brass, is but eight inches in height with the usual magnets and reaction coils. The carbons, as will be seen, are inclined at a vertical angle, and they have no sliding contacts to become heated or loosen the connections.



COCHRANE ARC LAMP.

They are also provided with a clutch which causes both carbons to be operated positively together. These pass through a reflector of porcelain into a clear globe which is surrounded by an opal globe eight inches in diameter and four inches deep. Other features are that the lamp is much lighter in construction and will, it is claimed, burn for 20 hours, with one pair of 7-inch carbons. The supporting hook is insulated with rubber, which permits vibration passing into the support itself. The inventor is Walter J. Cochrane, of Le Roy, N. Y.

NEWS OF THE WEEK.

Financial Intelligence.

THE WEEK IN WALL STREET was a lively one, seeing a heavy decline in stocks and the beginning of recovery due to the check on speculation and the improved bank showing. Last week, 5,211,900 shares were traded in as compared with 3,571,112 in the previous week, and only 2,076,000 in same week of 1898. Those figures tell a story of great bear pounding against the traction stocks. In Brooklyn Rapid Transit, Metropolitan and Manhattan the sales were over 1,250,000 shares or more than 25 per cent. of a market containing 175 issues and all the great steam roads! In fact, street railway securities become more and more a factor in the general market. Brooklyn Rapid Transit closed the week at 89⅜, a gain of 1⅜. Metropolitan Street Railway rose to 202¼, a gain of 8¼, and Manhattan Elevated to 109½, a gain of 1¼. On sales of 2,000 shares General Electric was strong, amid the decline going off only ½ to 122, and on 5,057 shares, Western Union rose ½ to 87¾. In Boston, American Bell Telephone closed at 362, Michigan Telephone soared to 105, Erie Telephone reached 113, and Mexican closed at 6, while New England was strong at 155. Massachusetts Electric Companies preferred closed at 81. In Chicago, West Chicago Railway Consolidated closed at 106½; Union Traction 33 common and 83 preferred; West Chicago Railway 120; National Carbon common 20½. In Philadelphia, Electric Storage Battery was weak at 136-138 common and 130-135 preferred; Electric Company of America, 18-18¼; National Electric, 11¼-11⅜; Pennsylvania Manufacturing Company, 28⅞-29. Union Traction was 40⅛; Philadelphia Traction, 96⅝; Pennsylvania Electric Vehicle Company, 13½; and General Electric Automobile, 6-6½. In the New York outside market, the new Electric Axle Lighting closed at 5½-6; Electric Boat, 21-24 common, 41-45 preferred; Electric Vehicle, 95-100 common and 115 preferred; New York Electric Vehicle Transportation, 22-22½; New England E. V. T., 8½-9¼; Illinois E. V. T., 4½-5; General Carriage Company, 33-35; General Electric Automobile, 17-24; Otis Elevator, 33-35 common, 96-98 preferred; Columbus Street Railway, 108-111. Other stocks were inactive.

ANNUAL REPORT OF ELECTRIC VEHICLE.—The annual report of the Electric Vehicle Company shows statement of earnings as follows:

From Jan. 1 to Aug. 31, 1899:		
From patent licenses		$155,000
From sales of vehicles		412,143
From other sources		6,387
		573,530
Contra:		
Legal expenses	$9,257	
Taxes	8,703	
General expenses	17,600	
Contingent expenses	4,722	
		40,283
Net earnings		533,246
Dividends paid		324,800
Undivided profits		208,446
The profit on investments according to market values on Sept. 1, 1899, amounts to		$1,028,000
Total undivided profits		1,236,446

President Isaac L. Rice further exhibits:

The treasury resources of the company on Sept. 1, 1899, are as follows:

Cash	1,575,184
Securities (market value)	2,268,000
Other securities (appraised value)	2,027,961
Sundry debtors	32,580
Bills receivable	158,000
Vehicles in process of construction (ordered before the organization of the Columbia & Electric Vehicle Co.) and materials on hand less accounts payable	55,573
Total treasury resources	6,117,290

No balance sheet is given.

The president's report in part states that special transactions were made in the following manner: The stock of the Columbia & Electric Vehicle Company was taken in equal proportion by the Electric Vehicle Company and the Columbia Automobile Company, respectively. The entire capital stock of the Siemens & Halske Company was purchased; the New York, New England and Pennsylvania Companies were the pioneer organizations antedating the Columbia & Electric Vehicle Co. They paid into the treasury of the Electric Vehicle Company the sums of $80,000, $25,000 and $50,000 respectively, for the privileges conferred. The Illinois Vehicle Company paid 20 per cent. of its full-paid capital stock, one-half of which has gone into the treasury of the Electric Vehicle Company, and the other half into the treasury of the Columbia Automobile Company. The large sum of $7,400,000 in cash is immediately available for the purchase and operation of the product controlled by the Electric Vehicle Company, while the total amount of $72,000,000 will become available as required. The sources of income are: Disposal of rights, manufacturing profit, operating profit, and ownership of the Siemens & Halske Electric Company of America. The following were elected directors for the ensuing year: Isaac L. Rice, Martin Maloney, Robert McA. Lloyd, John Jacob Astor, George H. Day, Arthur Phillips, Thomas J. Reagan, Daniel H. Shea and Joseph M. Hill. The five last named take the places of Rudolph Kissel, Talbot J. Taylor, Frederick Vieweg, W. W. Gibbs and Sigmund Lehman.

THE WALKER COMPANY'S AFFAIRS.—A suit has been commenced in the United States Circuit Court at Cleveland by the Standard Trust Company of New York, to have the business of the Walker Company, that city, placed in the hands of a receiver. The complainant says in its petition that on Dec. 20, last, the Walker Company issued bonds to the amount of $1,175,000, known as second mortgage, 5 per cent. thirty year gold bonds. On that date the Walker Company gave the plaintiff a mortgage to secure the total authorized issue of bonds, amounting to $1,650,000. The mortgage covers the Walker Company's plant and real estate in Cleveland and in New Haven, Vt., and all their patents. The mortgage provided that if the defendant failed to pay interest upon the bonds at the expiration of sixty days, after the interest became due, the principal on all the bonds should become due at the option of the holders of a majority of the bonds. The petition alleges that on Jan. 1 last there became due on the bonds, 1175 in number, $29,375 in interest. It is alleged that the coupons were sent to New York and that the payments of the interest was demanded on May 1, but that no part of the interest was paid. On Sept. 6 the holders of the majority of the bonds exercised their option to declare the principal of all the bonds due. It is alleged that there is now due upon the mortgage, the principal and $29,375 in interest, payable Jan. 1, and a similar amount of interest, due July 1. The Trust Company says it believes the Walker Company is insolvent and wholly unable to pay its debts, and that the company's property can not be sold in parcels without great injury to the holders of the bonds. The Trust Company asks that a receiver be appointed to carry on the business of the Walker Company and that the defendant be enjoined from interfering with the receiver's possession and control of the property, and from selling or incumbering the property. It also asks that the mortgage be declared a lien upon the property; that the amount due be ascertained and established a lien upon the premises, and that the defendants be required to pay the amount due upon the bonds. In default of payment, the Trust Company asks that the plant of the Walker Company be sold and that if the proceeds are insufficient to pay the bonds, execution be issued upon the company for the balance.

THE NATIONAL ELECTRIC "TRADE."—The "official announcement" of the Pennsylvania Manufacturing—National Electric trade will probably be the circular of the combining companies to stockholders, as was the case when the Pennsylvania Heat, Light & Power went into the Pennsylvania Manufacturing Company, stating the offer by which they can sell their stock and receive in exchange the bonds and the rights in the new company. This notice is now likely to come at an early day. The capitalization of the new company has now been definitely fixed at $25,000,000 stock, of a par of $25—not $50, as has been supposed—per share, and about $15,000,000 of the collateral trust 4s. This will make 1,000,000 shares of the new stock, upon which 10 per cent., or $2.50 per share, will be called. It is understood that while the National Electric people will have representation in the board the dominant party will be those who are now the leading spirits in the Pennsylvania Manufacturing Company.

STANDARD ELECTRIC COMPANY.—Prince Poniatowski, president, and his engineer, Mr. W. R. Eckert, has been East for some time making plans and contracts for this California enterprise, which has placed a large order with the Sprague Electric Company. It was organized last winter with $5,000,000 capital in $100 shares, and issued all but five shares to the Pacific syndicate, and its associates for transferring to the new company all properties such as power houses, rights of way, contracts, franchises, etc., and for agreeing to sell the new company the Pacific syndicate's holdings in the Blue Lakes Water Company, 66,000 shares, at $6

per share. The Blue Lakes Company was organized with $10,000,000 capital in 1892, and now controls not only the Blue Lakes and reservoirs in Amador County, but riparian rights along Mokelumne River and 15 miles of distributing canals, and last fall had contracts signed for delivering electrically 8,500-hp out of 14,800-hp available. The Pacific syndicate furnishes the new company with $100,000 cash, and agrees to purchase at 90 per cent. of the face value as many of the Pacific syndicate's first mortgage bonds as may be necessary to cover the construction of the San Jose, Oakland and San Francisco circuits. The company is offering $2,000,000 first mortgage 5 per cent. bonds. W. H. Crocker is vice-president and treasurer.

GENERAL ELECTRIC.—Discussing this company's affairs, the *Boston News Bureau* says: We understand that the General Electric Company is turning out goods at the rate of more than $20,000,000 per annum and is earning at the rate of nearly $5,000,000 net per annum. If business keeps up with the General Electric Company as at present, the company must look around for some more old accounts to continue its business of "charging off," else it may be forced to show more than 20 per cent. earnings on the common stock.

PHILADELPHIA UNION TRACTION.—The annual report of this company shows gross earnings $12,036,266 and net $7,000,191. The clear net is about $242,800 more. Taxes, etc., were $991,101 and fixed charges $5,634,725, leaving a surplus of $617,073, or a gain of nearly $600,000 over 1897-8. The increase for September in gross is put at about $200,000. Dividends are expected within a year.

WESTINGHOUSE-WALKER.—The Westinghouse Electric & Manufacturing Company has absorbed, under foreclosure proceedings, the Walker Electric Company, of Cleveland, O. The former company has for some time controlled both bonds and stock of the latter under the deal of last year.

NEW ENGLAND TELEPHONE & TELEGRAPH COMPANY has purchased the Manchester Telephone Company for $8,000. This company was originally capitalized at $125,000, but how much of this stock was issued is not known.

THE STROWGER AUTOMATIC TELEPHONE COMPANY has declared a dividend of $1.50 a share on its outstanding stock, payable Oct. 10. The company's automatic system has been adopted by the Illinois Telephone Company.

AMERICAN BELL TELEPHONE.—The directors of the American Bell Telephone Company have declared a regular quarterly dividend of 3 per cent., payable Oct. 16. This makes a total of 10½ per cent. so far this year.

CHICAGO UNION TRACTION.—It is announced by a prominent interest in Chicago Union Traction that a quarterly dividend of 1¼ per cent. will be declared on the preferred stock in October.

THE BOSTON ELECTRIC LIGHT COMPANY has declared a regular quarterly dividend of $1.50 per share, payable Oct. 14.

THE NATIONAL CARBON COMPANY has declared a dividend of 1¾ per cent. on preferred stock, payable Oct. 14.

Commercial Intelligence.

THE STATE OF TRADE.—It anyone has doubts as to the enormous volume of business being done, he had better take a walk around the various districts in New York City where merchandise is handled in bulk packages. Another test in the electrical business would be to visit the various factories and supply houses. In New York, he might even get an exaggerated impression of electrical activity, owing to the great demand for material for the Dewey welcome. One concern visited early last week had already sold some 30,000 lamps and over 60 gallons of coloring liquid, all for Dewey illuminations outside buildings, and the orders were then piling in at a great rate. Dewey stands for expansion of many kinds, and the industrial growth started just about the time of Manila May Day goes steadily on. Dun's *Weekly Review* says, indeed, that the volume of business continues beyond all precedent, exchanges for the week exceeding last year's by 41.5 per cent. and those of 1892 by 62.7 per cent. Failures for three weeks have been $3,977,268 in amount, against $3,529,350 last year, $5,621,518 in 1897, and $18,019,232 in 1896. Manufacturing have been $631,106 against $1,159,835 last year, and trading $1,843,550 against $1,876,452. A single real estate brokerage failure for $1,433,000 makes a difference of more than a million compared with last year. Failures for the week have been 154 in the United States, against 173 last year, and 18 in Canada, against 16 last year. The gross earnings of all steam railroads in the United States reporting for the first half of September are $17,332,082, a gain of 10.1 per cent. over last year and 12.5 per cent. over 1892. In volume, traffic is relatively larger than in July and August. The increase over last year in September is scarcely up to July and August, but last year there was a considerable setback in those two months. Going back to 1892 the gain in September is greater than for any month since May. Roads reporting include many leading systems, embracing nearly 75,000 miles in the United States. In the metal market, Bessemer and anthracite pig are unchanged, Grey forge at Pittsburg and Chicago and Southern iron are higher, bars $2 per ton higher, and plates $3 per ton, and rails $1 per ton. Most of the business is for next year, with premiums paid for more speedy delivery. Copper has been steady around 18½ cents. A large increase of output is expected.

NEW WHEEL-PIT AND POWER HOUSE FOR NIAGARA.—By far the most interesting news that has come from Niagara Falls in many days is to the effect that the Niagara Falls Power Company has invited twenty well known contracting firms to make proposals on the construction of a new wheel-pit the full size of the present pit. This means that the big slot will be over 400 feet long, 179 feet deep and 20 feet wide. It is to be located on the inlet canal opposite the present station, the inlets being already provided. The bids are to be opened on Oct. 5. This means, of course, that a new power station is to be erected. The wheel-pit will have room for turbines that will develop 50,000-hp, and this will double the company's output capacity. While the Niagara Falls Power Company does not, at this time, state how many turbines will be installed at the start, it is most significant that the contracts will call for the construction of the entire pit as well as the connecting tunnels to the main tunnel. When the original installation was made the first section of the pit was about 140 feet long, after which it was extended to its present dimensions. In the new work, the pit is to be built full size at the start. The tunnel, as originally planned, was designed for 120,000-hp, so there are ample tail race facilities in it for the proposed new installation. The letting of the contracts implies that many more millions of dollars are to be expended at the Falls in the development of the power resources. This means that there will be a great call for labor, while the skilled mechanics in many manufacturing plants will recognize that it means also increased business for the firms for which they work.

EXPORTS OF ELECTRICAL MATERIALS FROM NEW YORK.—The following exports of electrical materials are from the port of New York for the week ending Sept. 23: Antwerp—30 cases electrical material, $4; Amsterdam—8 cases electrical material, $450; Argentine Republic—117 cases electrical material, $8,920; Brazil—10 cases electrical material, $191; British East Indies—1 package electrical material, $15; British Possessions in Africa—101 cases electrical material, $5,750; Bremen—1 case electrical material, $49; Bristol—2 cases electrical material, $44; Central America—96 packages electrical material, $497; Copenhagen—3 cases electrical motors, $87; Dutch West Indies—2 packages electrical material, $46; Ecuador—1 case electrical material, $13; Glasgow—79 cases electrical material, $7,025; 2 electrical machines, $210; Genoa—2 cases electrical material, $16; Havre—81 cases electrical material, $9,578; London—48 packages electrical material, $5,309; 26 cases electrical machinery, $4,210; Liverpool—135 packages electrical material, $7,528; 3 packages electrical machines, $49; Mexico—260 cases electrical material, $1,491; 4 cases electrical machines, $779; 1 case electrical machinery, $779; 1 case electrical machines, $27; New Zealand—1 package electros, $180; Peru—7 packages electrical material, $115; St. Petersburg—13 cases electrical material, $1,399; Venezuela—46 packages electrical material, $346.

MR. EDISON AND HIS WORK.—If one were to credit all the current stories about Mr. Edison, he would have to be credited with half a dozen heads and several pairs of hands. As a matter of fact, to-day not less than in the famous old Menlo Park times, he is at work on a number of things all at once, and his confidential associates, Messrs. Upton, Mallory and Gilmore are kept busy meeting the thousand and one requirements of such a Briareus. While Mr. Edison may be busy with new lamps, gold ore milling, automobiles, phonographs and a few other trifles, it is not less true that he is immensely interested in his new cement factory, based on some of his rock crushing inventions. Out at Orange, he has fitted up what may be described as a pattern shop on a huge scale, to show just how everything will look and operate in the cement plant, and he is about ready to give out the contracts for the construction of the factory itself, representing probably a cool million in investment and 1000-hp to drive it. The plant will be run, wherever possible, by electric motors from a central generating plant. Meantime, the Edison phonograph shops, grinding up human speech and instrumental records for domestic and foreign consumption, were never busier.

WESTERN ELECTRIC ACTIVITY.—President E. M. Barton, the well known president of the Western Electric Company, has recently been in the East. Being interviewed as to the work of his

company he said: "The delay in furnishing telephonic apparatus is caused by the enormous rush of orders and the failure to secure promptly the raw material, together with the fact that the best skilled labor is required on electrical work and about all the available workmen of this class are employed. We shall be pretty well up to the demand by Jan. 1. The heavy canvass put forth by the managers of the Pacific Central Union & Erie Companies has inspired all the Bell licensees in the country to push their business, hence the demand for material. We have orders for over 50 of the latest relay switchboards such as are now in operation in Cleveland, and to turn one out of that capacity requires about one year's time. The cost of the board before leaving the factory is about $100,000, and it costs $50,000 to install it." Mr. Barton said his company also had a very heavy foreign trade, which taxed the capacity of its departments at Paris, London and Antwerp. The damage to the cable factory in London was not, it appears, so great as at first reported.

DEVELOPMENT IN UTAH.—Colonel Alexander H. Tarbet, who recently sold the Center Star gold mine at Rossland, B. C., for $2,000,000, and who has just purchased the After Thought Copper Mines of Shasta County, Cal., has been visiting New York for the purpose of buying machinery for the development of his mining properties. With Colonel Tarbet was A. G. Lamson, of Salt Lake City. They own the Salt Lake City Water & Electrical Power Company, for which they have also been placing orders for machinery. This company's plant is situated on the Jordan River, twenty-two miles south of Salt Lake City, and furnishes power to the mills and mines of Mercur, the famous gold camp of Utah, and also to the Camp of Bingham equally famous for its copper production. "In all my experience," said Col. Tarbet, "I have never seen such all-around prosperity as at present prevails. This is particularly exemplified in manufacturing. Even at the high prices now ruling it is impossible to have orders for machinery promptly filled, manufacturers demanding at least six months' time. A large firm refused to accept any orders from us for electrical material at less than seven months, and declared that they were daily getting further behind in filling contracts."

FUEL ECONOMIZERS.—Recent power house and central station work has caused a brisk demand for many auxiliary appliances. The Green Fuel Economizer Company, for example, report recent sales of Green's economizer for the following electric power plants: Third Avenue Railroad Co., New York, 32,000 B. H. P.; the Independent Electric Co., San Francisco, Cal.; Western Electric Co., New York and New Orleans, La.; Metropolitan West Side Elevated Railroad Co., Chicago, Ill.; People's Light & Power Co., Hoboken, N. J.; Chicago & Milwaukee Electric Railway Co., Highwood, Ill.; Topeka Edison Co., Topeka, Kan.; Rapid Railway Co., New Baltimore, Mich.; Queensboro Electric Light & Power Co., Far Rockaway, N. Y.; Santa Monica Electric Co., Santa Monica, Cal.; Atlanta Consolidated Street Railway Co., Atlanta, Ga.; Fremont & Norwalk Railroad Co., Fremont, O.; Boston Terminal Co., Boston, Mass.; Grand Rapids Municipal Electric Light Plant, Grand Rapids, Mich.

APPARATUS FOR JAPAN.—An interesting electrical and pneumatic plant has just been ordered for Japan. The Chicago Pneumatic Tool Company, from their office at 120 Liberty street, have closed a contract for a large installation of pneumatic tools for the Sanyo Railway in Japan. The outfit includes three 50-hp electric motors, three 50-hp belt driven air compressors, three air receivers of very large capacity and full equipment of pneumatic riveting, drilling, calking and chipping tools, hoists, etc. The generating plant and motors will be furnished by the General Electric Company and will consist of three-phase apparatus operating at 60 cycles. The plant is not intended in any way for the operation of the road, but for the company's large workshops. Mr. W. P. Pressinger, the secretary-treasurer of the Tool Company, considers the plant a very interesting one and the placing of the order shows the Japanese to be up-to-date in all that pertains to electrical and pneumatic apparatus.

AGENTS IN ENGLAND.—We are advised of the taking over of the firm of Julius Sax & Company, 119 Cold Harbor Lane, London, S. E., by a new combination. It has been established for 50 years and has secured gold medals at many exhibitions as artistic metal-workers, manufacturers of telephones, fire alarm appliances, bells, railway signal material and all bellwork appliances. The special sphere of the business is the carrying out of Government contracts. The new managing director, Mr. H. M. Salmony, has a very large trade connection with the electric lighting and tramway world of Great Britain; but as the present works of J. Sax & Company are fully occupied with the manufacture of the above mentioned goods, Messrs. J. Sax & Company are ready to take up agencies for motors, arc lamps, railway supplies or any similar articles which may be required in the trade, from this side of the Atlantic, where they are already well known.

BROOKLYN NAVY YARD PLANT.—As already intimated, trouble is being made over the contracts for the two-phase plant in the Brooklyn Navy Yard, and the matter has got into the newspapers on the ground that direct current would be better for so limited an area as the machine shop. In an article on the subject, the *Evening Post* says: "The specifications call for a power plant which the bids received prove will cost $175,000, while there has already just been purchased for the Brooklyn Navy Yard a power plant at a very considerable expenditure of money, and which would be well able to supply the demands of this new machine shop. Not only, it is alleged, would this save this expenditure on the part of the Government, but the consolidation of all the power-generating apparatus at one point results in a production of the aggregate power at a very much lower cost than if that amount of power were generated by two or more smaller stations."

COMMERCIAL AFRICA IN 1899 is the title of a publication just prepared by the Treasury Bureau of Statistics. It shows present commercial conditions in Africa, and incidentally the political divisions as they now exist, and is accompanied by a map showing the boundary lines of the various colonies, protectorates, spheres of influence and independent States of this great continent whose map has so rapidly changed during the past few years. A table accompanying the monograph shows the imports and exports into and from each of the divisions. The imports amount in round numbers to $400,000,000 and the exports to $350,000,000, while of the imports, $18,000,000 is furnished by the United States, and of the exports, $10,000,000 is sent to the United States. In the electrical and machinery lines, South Africa is rapidly improving as a market for American apparatus.

FLATS AND ELEVATORS.—Attention was recently called in these columns to the great opportunity for electric elevators in new apartment houses, and the *Mail and Express* was quoted in support. Now comes the *Commercial Advertiser* with further testimony, saying: "The electric elevator has been an absolutely revolutionary factor in the evolution of the *parterre* house. It has made the seventh, eighth, ninth and tenth floors equally desirable with the second and third, and landlords need make no differences in the rent. Under eight stories the law does not require absolutely fireproof construction, but builders have fared so well with this class of house that they are talking extensively of nine and ten story fireproof houses as the next step in this evolution." The electric elevator field will pay for watching and development.

CANADIAN CARBIDE PLANT.—The Berlin Iron Bridge Company, of East Berlin, Conn., have the contract for furnishing the structural steel work for three buildings for the Ottawa Carbide Company, of Ottawa, Canada. The buildings are from three to five stories high, and consist of a furnace building 80 feet wide and 286 feet long, a grinding room 38 feet wide and 80 feet long, and a breaking room 35 feet wide and 80 feet long, and two stories high. The floors are carried on steel beams and columns, and the flooring is steel plate. The trusses have a clear span, and the roofing is corrugated iron. The bins for the storage of material are all of plate iron. No woodwork is used anywhere in the construction of the building.

TELEPHONE EXPENDITURES.—A large amount of money is being spent by the Bell telephone companies just now, and new expenditures are planned. A nine-story brick and stone office building, 24.11x115.4, which the New York Telephone Company is to build for its own occupancy at No. 14 Cortlandt street, will cost $100,000. Another example is the Erie Company, which is establishing in all its principal cities main and branch exchanges in buildings owned by the company, which will number when completed 62 in about 45 cities, and valued at about $1,500,000. In Boston, the parent Bell Company is to do some heavy building.

APPARATUS WANTED FOR TUSCOLA, ILL.—It is the intention of the Culver Electric Company, which has been granted a franchise at Tuscola, to have the entire plant installed in operation by Christmas. It is now in the market for pipe, pumping machinery, dynamos, engines, boilers, etc. J. S. Culver, Springfield, Ill., is treasurer, and J. H. Culver, Decatur, president. The plant is to be located in the heart of the city and the water supply will be taken from an artesian well 3,080 feet deep.

THE DUNDEE, SCOTLAND, ROAD.—A special cable despatch to the New York *Commercial* says: The contract for wire, poles and insulators for the 4-mile trolley line about to be constructed in Dundee, Scotland, is to be filled by American manufacturers. The rail bonds will also be of American make. Twenty-seven thousand "Chicago" and "Crown" rail bonds are about to be ordered by the Glasgow Municipal Electric Road.

THE GENERAL ELECTRIC COMPANY has purchased 15 acres of marsh lands adjoining its Lynn, Mass., works for the purpose of extension of its plant there, formerly the Thomson-Houston factory.

Special Correspondence.

NEW YORK NOTES.

New York, Sept. 25, 1899.

SPECIAL ILLUMINATIONS.—The city authorities are wisely calling attention to the fact that while permission is granted for special Dewey electrical illuminations on the piers and wharves, such work must be in strict accordance with the Underwriters' rules and with those of the public building department.

ELECTRIC TRAINS TO BRIGHTON BEACH.—The Brooklyn Rapid Transit Company has decided to do away with the trolley service on the Brighton Beach line and operate nothing but electric trains from the Bridge, by way of the King's County Elevated Railroad, to the beach. The change will be made in a few weeks.

THE NON-POLARIZING DRY BATTERY COMPANY, 625 Broadway, manufacturers of the well known O. K. dry battery, are now represented in Philadelphia by the Novelty Electric Works and in Boston by Pettingell-Andrews Company. The O. K. is meeting with great favor wherever used, and has been adopted for exclusive use by the U. S. Signal Corps, also by the Pullman Palace Car Company over its entire system.

NORTHERN ENGINEERING COMPANY has been doing a good deal of work lately, as noted in these columns. Its offices are at 39-41 Cortlandt Street, and articles of incorporation have been filed with the secretary of state of New Jersey. The capital of the company is $15,000. The incorporators are Theodore W. Kloman, G. Blake Garrison, M. A. Kloman, George C. Hoffman and Robert J. Garrison. T. W. Kloman will be president of the new company and G. Blake Garrison secretary and treasurer.

THIEVES AND TELEPHONES.—The telephone figured largely in the capture of an alleged burglar at Bath Beach last week. A bartender, getting ready for the day in a saloon, discovered two burglars at work in the grocery store on the corner opposite. He promptly rang up police headquarters on the telephone, and told the operator on duty of his discovery. The operator in turn called up the Bath Beach police station and a roundsman and patrolman hurried around to the grocery. The burglars made off at their approach and the policeman gave chase. One man was captured.

MR. C. O. MAILLOUX, the well known consulting engineer, American Tract Society Building, has returned recently from a prolonged trip to Chicago on important professional business. The plants in some of the choicest and costliest buildings in New York owe their success to Mr. Mailloux's skill and experience, but lately he has had to take up another quite distinct branch of work, and has been engaged in developing some very interesting power transmission enterprises in the Far Far West. The problems involved are very different from those of a huge hotel, a palatial residence or a tall office building.

MR. GEORGE J. GOULD arrived in New York last week on the American Line steamship St. Paul. He went at once to his office, at 195 Broadway, where he talked a little about his trip abroad, about business conditions and the Manhattan Elevated Railroad. Mr. Gould did not have anything to say about the tunnel, but he said the preparations for providing rapid transit on the elevated road were well under way. "Ground has been broken for the new power house. The engines have been ordered, and the third rail equipment has been provided. Preparations are well under way. It is impossible to say now when the work of installation will be begun."

TRAIN LIGHTING.—The Delaware, Lackawanna & Western Railroad will inaugurate this week a new system of car illumination, whereby the axles of the car wheels are utilized to furnish electric power for incandescent lamps. Dynamos are mounted on the car trucks by means of cradles, and power is obtained by means of a friction appliance on the axle. An appliance for automatically oiling the car axle will also be tested. If successful this scheme may mean a lowering of the record for long runs, as much time is now consumed by present methods of oiling up. The apparatus is that of the Electric Axle Lighting Company of 100 Broadway.

THE RAPID TRANSIT CONTRACT.—Members of the Rapid Transit Railroad Commission expect that the form of the contract for the construction of the proposed underground tunnel will be ready to be submitted to Corporation Counsel Whalen early this week. The work of preparing this contract is in the hands of the counsel to the committee, and it is well advanced. It is the intention of the Rapid Transit Commission to submit the form of contract to Corporation Counsel Whalen in sufficient time to enable him to read it, and give it his approval before the 1st of October. Should Mr. Whalen be disposed to indorse this contract promptly, it will be advertised immediately.

EDISON COMPANY OF BROOKLYN.—The following directors were elected at the annual meeting of the stockholders of the Edison Electric Illuminating Company of Brooklyn last week: Nicholas F. Brady, Daniel J. Creem, A. W. Dater, H. C. Du Val, J. D. Fairchild, Bernard Gallagher, John G. Jenkins, Thomas E. Murray, Royal C. Peabody, Henry Seibert, W. F. Sheehan, James N. Wallace and A. M. Young. The following officers were elected: President, Bernard Gallagher; First Vice-President, Henry Seibert; Second Vice-President, Royal C. Peabody; Secretary, W. W. Freeman; Treasurer and Assistant Secretary, A. W. Dater; Assistant Treasurer, A. N. Neilsen.

STATEN ISLAND LIGHTING.—The officials of the New York and Staten Island Electric Light Company have notified Henry S. Kearny, Commissioner of Public Buildings, Lighting and Supplies, that if the bills of the company against the city for light are not paid the lights in all the streets will be put out Oct. 1. The company has received no money for twenty months, although the money that was raised by the lamp tax in the old village is now in the hands of the Controller. The company is now supplying current for 3459 lights, of which 451 are arc and the rest twenty-five candle power incandescent lights. The city now owes the electric light company over $175,000 for lights since the consolidation, and a suit has been begun to recover that amount.

THE UNITED STATES MOTOR VEHICLE COMPANY, which was incorporated the first of the month under the laws of New Jersey, with $1,500,000 capital stock, have opened up their offices in the Townsend Building, Twenty-fifth Street and Broadway, this city. This company, it is understood, have secured some very strong patents, have already developed types of gasoline, electrical and other vehicles, and will be on the market very shortly, with both pleasure and commercial vehicles, comprising different types of carriages, delivery wagons, trucks, omnibuses, coaches, etc. Their different types of gasoline engines will be sold separately to the trade where desired, and they will make marine and stationary types of engines to sell. Mr. C. J. Field, who has been prominently identified with electric railway, central station work and Edison interests for the past 12 years, is largely interested in this company, and is the vice-president and general manager.

THE HOLLAND BOAT had another fine test at Little Peconic Bay last week, and showed up, or rather showed under, splendidly. After the torpedo had been discharged, while she was under water, Mr. W. R. Eckert, consulting engineer for the Standard Electric Company of California and also for the Union Iron Works of San Francisco, which company built the battleship Oregon, the cruiser Olympia, and several of the fast torpedo boats, went on board to inspect the vessel, and also to examine the machinery while she was running under water. He said, when asked about the boat and its performance: "I am very much pleased with the exhibition, and am convinced there is no trouble for the boat to do all that is claimed for it. I have been on the trial trips of many new vessels built for the government, and would say I would rather be and feel safer in the Holland boat when under water than in the engine or fire rooms of any of the fast torpedo boats. I consider her absolutely safe."

SUES B. R. T.—Justice Garrettson to-day in the Kings County Supreme Court, heard a motion for a writ of mandamus to compel the Brooklyn Rapid Transit Company to produce its books for inspection. The suit is instituted by Frederick F. Marquand of 8 Broad Street and 412 South Street, Brooklyn, whose attorneys are Lamb & Voss of the Mutual Life Building. Mr. Marquand, as a stockholder of the Rapid Transit system, contends that he has a right to know the exact condition of the corporation. He aims at a conservative management of Rapid Transit affairs. He is, his lawyers say, particularly interested in the unsatisfactory judgments against the company in accident suits which existed when the annual report was issued, and has devoted time and money to a drastic analysis of them, with the result of satisfying himself that 75 per cent. of them originated, not at what are known as "danger points," but at places where, with reasonable care, there should be no excuse for accident. His deduction is that the entire system is grossly mismanaged.

SALE OF CAR STABLES.—One of the last official acts of the late Cornelius Vanderbilt, as president of the Harlem Railroad Company, was to sign a deed conveying the old Fourth Avenue car stables to a representative of the Metropolitan Street Railway Company. The deed included the Eighty-sixth Street and Madison Avenue car depot also, and was delivered, and the title guaranteed by the Title Guarantee and Trust Company in the sum of $1,350,000, on the day before Mr. Vanderbilt died. The Fourth Avenue and Twenty-third Street property had been purchased by the Harlem Railroad Company at various times, but the greater portion of it had belonged to the company since 1851. The Metropolitan Company now holds, with title guaranteed by the Title Guarantee and Trust Company, four very valuable pieces of New York real estate. The other two, besides those mentioned above, are the depot comprising the block between Sixth and Seventh Avenues and Fiftieth and Fifty-first Streets, and the cable building at the northwest corner of Broadway and Houston Street.

TELEPHONE WAR TAX.—The Collector of Internal Revenue of the Second District, acting upon instructions from Commissioner of Internal Revenue Wilson at Washington, has requested the New York Telephone Company to furnish a sworn statement of the number of messages sent under the contract for 600 messages for $90 contracted between July 1, 1898, and May 1, 1899. This is to enforce the war tax of a cent a message, which the telephone company made strenuous efforts to evade. After all legal means were exhausted, the company appealed to Commissioner Wilson. Soon after the war tax was levied the company reduced its toll of 10 cents for messages from 15 cents. Later the price of private lines was reduced from $90 to $75 for 600 messages. If the subscriber to the private line sent less than 600 messages the rate, it is claimed, was necessarily brought under the war tax ruling. It is on this point that the late ruling was made. It is estimated that the amount due the government from the telephone company under the ruling is between $5000 and $8000.

THE NEW TELEPHONE COMPANY of New York City, with a capital of $10,000, was incorporated last week at Albany. Beside the general city route, points are to be connected at Yonkers, Poughkeepsie, Hudson, Troy, Albany, Saratoga, Plattsburg, Ogdensburg, Watertown, Oswego, Schenectady, Little Falls, Utica, Syracuse, Rochester, Buffalo, Dunkirk, Hornellsville, Middletown, Newburg, Nyack and all or any intermediate and adjacent cities, towns, villages, and other places in the state. The directors are William G. Conklin, Edward Ashforth, Melville Knowles, George W. Romaine, D. A. Reynolds, William P. Catlin and Charles F. Abell, of New York City. The new company is backed by the capitalists interested in the People's Telephone Corporation. Among them are members of the New York Board of Trade and Transportation. It is possible that both of these companies will be merged. At any rate they will co-operate, the new company handling the long distance business, while the People's Company will confine itself to the local business of this city and vicinity. It is understood that the capital of the New Telephone Corporation of the City of New York and the State of New York will be increased at an early date. The first construction is to be done in the vicinity of Yonkers, although work will start soon at two other places up the state.

PHILADELPHIA NOTES.

Philadelphia, Sept. 23, 1899.

DELAWARE CITY.—About 300 of the citizens of Delaware City held a meeting to consider the proposition of the proposed trolley line between New Castle and Delaware City to lay tracks in the streets of the city. With the exception of one vote the meeting was in favor of giving the desired permission.

WALKER ELECTRICAL CONSTRUCTION COMPANY, 249-253 South American Street, report among recent orders a disinfecting boat fitted up with storage battery plant for Havana harbor; a 42 circuit board for the new Rittenhouse office building, and three 1000 ampere three-pole double throw switches on generator panel, specially heavy panel construction for the Philadelphia *Press*.

THE GEORGE C. TOWLE MANUFACTURING COMPANY, of Lancaster, Pa., are at present installing an additional 50-hp engine and boiler to meet the requirements of their ever increasing business. They are making a specialty of designing special motors to be direct connected to machinery. They report having just received a large order for fans to be exported to South America.

BURLINGTON, N. J.—The Monmouth Traction Company, which is to operate a street line between Camden and Trenton, has completed a half mile of road on the outskirts of this city and has now transferred its operations to Beverly. A contract between the Monmouth and the Cinnamonson Electric Light Company, whose plant is located at Riverside, has been closed for this company to furnish the power.

THE C. J. TOERRING COMPANY, of 1035 Ridge Avenue, Pa., manufacturers of the Toerring enclosed arc lamp, have recently issued a very attractive little illustrated catalogue, describing their 200-hour enclosed arc lamps. This will be sent to anyone interested, upon application. It is said that in no recent lamp tests have they got less than 225 hours' life, using one 12 by ½ inch carbon.

CAMDEN TELEPHONY.—The old telephone exchange, which was established at Second and Market streets, Camden, N. J., when the telephone was introduced into the city, was abandoned last week, and all the calls are now connected with the new exchange at Fifth and Market streets. The change was made at 3 o'clock on Saturday, requiring just four seconds to make the transfer. Under the system the subscriber will take off the receiver and the central station will connect with the subscriber wanted, when the number is asked for.

NEW ENGLAND NOTES.

Boston, Sept. 25, 1899.

PASS & SEYMOUR, the well known electrical porcelain manufacturers of Syracuse, N. Y., have opened an office in Boston, in the New England Building, 200 Summer Street, where they will carry a full stock of their goods. It will be in charge of Mr. A. B. Field, who is well known among the electrical trade in this part of the country. Mr. Field will be glad to have the electrical fraternity call on him at the new office and to receive inquiries there.

THE BOSSERT ELECTRIC CONSTRUCTION COMPANY, of Utica, N. Y., have purchased the patents of the Erickson Electric Equipment Company, of Boston, on outlet boxes and conduit insulators, and will hereafter manufacture these goods in conjunction with their own well known steel boxes. The Underwriters having passed a rule that the outlets must be provided with an insulating bushing, the Bossert Company are thus enabled to fulfil all the necessary requirements for a complete interior conduit installation.

STURTEVANT ELECTRICAL DEPARTMENT.—For a third of a century the name "Sturtevant" has called to mind visions of fan blowers, heating, ventilating and drying systems and the like. To-day, however, the name has added significance, for it is also suggestive of high grade steam engines, electric motors and generating sets. For years the Sturtevant engine has been gradually developed and perfected, while the past decade has witnessed the rapid growth of the electrical department of the B. F. Sturtevant Company. At the present rate of development it bids fair to overtop all other lines of manufacture in this well known establishment. The company report great activity in it and many new orders.

CHICAGO NOTES.

Chicago, Sept. 23, 1899.

MR. GERARD SWOPE, formerly of the engineering department of the Western Electric Company in this city, now represents the company in St. Louis, Mo. His office is 10 Security Building.

MR. SAMUEL INSULL, president of the Chicago Edison Company, Chicago, has just returned to the city, after spending several days in New York and in meeting friends at the convention of the Edison Association. He goes East again this week.

MR. E. R. HARDING, of Harding & Hammer, Chicago, has gone east on a business trip, which will include a visit to the factory of the Holtzer-Cabot Electric Company, for which firm they are western representatives.

THE ILLINOIS ELECTRIC VEHICLE TRANSPORTATION COMPANY started their public service in Chicago Sept. 13, with nine first class vehicles in use. The demand for this service has taxed their facilities.

MR. J. C. HOBART, who is well known throughout the electrical fraternity, is visiting Chicago in the interests of the Triumph Electric Company, of Cincinnati, Ohio, this week. Mr. Hobart is largely to be credited with the rapid growth of this company, and reports that they are making great gains throughout the country.

GRANTS A HEATING FRANCHISE.—The Waukegan city council has granted the Waukegan Electric Light Company a 25-year franchise to construct and operate a system of public heating, piping hot water about the city. The Yaryan plan is to be used. An experimental line probably will be put in this fall.

MR. P. C. BURNS, president of the American Electric Telephone Company, Chicago, has just returned to the city after spending several weeks at the Waldorf-Astoria Hotel, New York. He is very much elated to find upon his return that business is brisker than ever, and promises to remain so for many months to come.

THE CHICAGO CITY RAILWAY COMPANY resumed cable service on the State Street line this week, after a shut-down of several weeks, during which time electric cars furnished service, under a temporary permit to use the trolley system on this line. During this time the cable drive was rebuilt, and the Wabash Avenue cable, which is operated from the same station, was driven by an electric motor. The trolley service will now be transferred to the Wabash Avenue line, while the cable drive for that system is being rebuilt.

STEALING ELECTRICAL SUPPLIES.—Three men are under arrest at the West Chicago Avenue police station for the confessed burglary of numerous stores and factories. Through their confessions the police have recovered large quantities of electric fixtures, parts of telephones and other goods. The prisoners are young men formerly in the employ of the Western Electric Company. Among the places named in their confessions as the scenes of their depredations are the Western Electric Company's factory. The value of the property recovered is $2500. One of the men was caught in the act of destroying the telephone in a police patrol box. Previously they had caused the Metropolitan Elevated railway great annoyance by cutting wires. At other places they had stolen incandescent light globes simply for the purpose of smashing them against the walls of buildings.

A NEW SAFETY STOP.—State Railroad Commissioner Kayler and J. C. Morris, inspector of railroads for Ohio, have been making a thorough test of the interlocking signal and brake systems manufactured by the Rowell-Potter Safety Stop Company of Chicago. At Pekin, Ill., a few days ago a train composed of two baggage cars and a private car, traveling at the rate of fifty miles an hour, was stopped within three train lengths, despite the fact that the power had not been shut off. There is an electric apparatus along the track which works signals and the power is secured by the deflection of the rails as the wheels of the engine and cars pass over it. There is an appliance which comes into contact with another on the engine, setting the emergency brakes on each of the cars.

ILLUMINATING THE UNION LEAGUE CLUB.—One of the most brilliant points along the routes of the various parades of the fall festival will be the Union League Club on Jackson Boulevard. The club has been the headquarters of most of the festival arrangements since the beginning, and has made generous provision for the illumination and decoration of the structure. The dome will be so covered with incandescent lights as to make a blazing area in the sky to be seen for miles out in the lake, while all the windows, the roof and the balconies will gleam with many-colored lights. The building will be festooned with the national colors and banners of all kinds. Almost in front of the building, near Dearborn Street, will be the great reviewing stand, to seat 15,000 people. The lines of march of all the parades have been arranged so that the glittering procession will pass the club house. This was in order to give recognition to the organization whose leading men have been so instrumental in making the festival a success.

PLANS OF AUTOMOBILE SHOW.—During festival week many private owners of automobile carriages, together with prominent manufacturers of motor vehicles of almost every character, will hold an exposition at Tattersall's under the auspices of the Arena Athletic Club. The automobile exposition is the first one of its kind of any magnitude that has been scheduled for the West. Among those who will have exhibitions, some of the firms entering as many as ten machines, are: Woods Motor Vehicle Company, of Chicago; Indiana Bicycle Company, of Indianapolis; Riker Electric Vehicle Company, of Brooklyn, N. Y.; American Electric Vehicle Company, of Chicago; General Electric Vehicle Company, of Philadelphia; Winton Motor Company, of Cleveland; Haynes & Apperson, Kokomo, Ind.; Locomobile Company, of Newton, Mass.; Duryea Motor Manufacturing Company, of Peoria, Ill.; Overman Wheel Company, Chicopee Falls, Mass.; Waltham Manufacturing Company, of Waltham, Mass.; Lewis Motor Vehicle Company, of Philadelphia; Munson & Co., Lafayette, Ind.

OMAHA NOTES.

Omaha, Neb., Sept. 23, 1899.

HENRY W. RUSTIN, superintendent of buildings and power for the Greater America Exposition here, has just received the appointment of superintendent for the power and mechanical department of the Pan American Exposition to be held at Buffalo, 1901.

SOUTH OMAHA.—The council of South Omaha have been restrained from passing an ordinance repealing a previous ordinance that granted a franchise to the Magic City Electric Light & Power Company in April last. The council claim that the franchise is illegal. In the meantime, the Magic City Company has extended lines from the New Omaha Thomson-Houston Plant in Omaha and is furnishing current to consumers and asserts its rights as a common carrier, to be left undisturbed in enjoyment of its business.

COWBOYS HOLD UP STREET CARS.—A dozen cowboys, under the leadership of Montana Bill, a western character of some fame, undertook to show Omaha a hot time on Sept. 16. After they had delivered a train load of cattle at the stock yards they began to charge motor cars, rushing in double columns at them and compelling the motormen to stop. They drew revolvers and, although they did not fire, their wild appearance and loud yelling created a panic. Finally Montana Bill's horse pitched him into an open car and the leader was arrested.

CINCINNATI NOTES.

Cincinnati, Sept. 23, 1899.

GENERAL MANAGER J. C. HOBART, of the Triumph Electric Company, is on a western business trip. He will look after some large contracts in St. Paul and Chicago.

DODD, WERNER & COMPANY, of Cincinnati, have secured the contract for electric fixtures to be used in the new home of the Business Men's Club of Cincinnati, now in process of remodeling.

THE CINCINNATI GASLIGHT & COKE COMPANY is sending around a circular which purports to show how and why the Welsbach burner in its operation is cheaper than electric light for household use. The company has an electric department.

MR. GEORGE BULLOCK.—His business associates at the Norwood plant of the Bullock Electric Company are looking for President George Bullock in about 10 days. Mr. Bullock has been enjoying the novel experience of canoeing in northern Canadian waters for several weeks in company with some boon companions.

MANAGER W. F HAYS, of the General Electric Company's Cincinnati office, is taking a very prominent part in the coming election of the Business Men's Club, the leading business organization of Cincinnati. Mr. Hays is on the nominating committee of one of the tickets, and is very likely to be pressed into service as a candidate.

FORD GLASS WORKS.—In addition to the already handsome order placed with the Cincinnati office of the General Electric Company, the managers of the Ford Glass Works at Toledo, which have just started, have ordered within the past few d.ys a 1000-kw. tri-phase alternator, six 100-hp. induction motors and five 200-hp. of the same class, all complete, with exciters and switchboards.

THE BULLOCK COMPANY has recently received from *The Scotsman*, the big Edinburgh paper, an order for four of their "teaser" equipments to operate as many large Hoe newspaper presses. This order makes about 15 equipments of this same nature the company has taken orders for in the past three months. It is stated at the office that the manufactory is four months behind orders and that business is constantiy increasing.

MEETING OF SUPPLY MEN.—Representatives of the most prominent western electric supply houses met in Cincinnati at the St. Nicholas Hotel last week and talked trade matters. The call as issued asked for a conference as to the best methods of treating delinquents and collecting bad accounts. W. W. Low, of Chicago, was named chairman of the meeting, and F. O. Vose, of Chicago, acted as secretary. The representation embraced all the most important jobbing houses in the west, members of the western division of the National Association. The Cincinnati houses represented were the Post-Glover Company and the Standard Electric Company. An agreement was effected in the matter of a system of handling delinquent accounts and bad debtors. The delegates expressed themselves well pleased over the conference and will meet at the call of Chairman Low next December. In the evening President Sam Glover, of the Post-Glover Company, F. D. Lawrence, of the Standard Electric Company; Manager W. F. Hays, of the General Electric Company, and Dan Hemingray, of the Hemingray Company, entertained the visitors with a trolley ride and supper at Chester Park. Those from Chicago were W. W. Low and wife, C. E. Brown, M. B. Austin, G. Searing, J. W. Wolff, R. V. Scudder, C. D. Baker, F. Overbaugh, A. Dee, A. Proctor, E. Jenkins and F. O. Vose. The St. Louisans were Russell Stanhope, F. C. Cranfkettler and Charles E. Ramp. Among others present were W. G. Nagels, of Toledo, and L. P. Cody, of Grand Rapids, Mich.

OHIO NOTES.

Cleveland, Sept. 23, 1899.

THE UNITED STATES TELEPHONE COMPANY has asked for a franchise for a telephone system in Circleville.

THE BOWLING GREEN ELECTRIC COMPANY is building an addition and increasing the capacity of its plant at Bowling Green.

ALLIANCE, O.—The commissioners of Stark and Columbiana Counties have granted the Alliance, Sebring & Salem Electric Railway Company a twenty-five year franchise. The road must be in operation within eighteen months.

THE SCIOTO VALLEY TRACTION COMPANY was incorporated a few days ago to build an electric line from Columbus to Chillicothe with the intention of ultimately extending it to Portsmouth. E. K. Stewart, general manager of the Columbus Street Railway Company, is at the head of the enterprise. The road will practically parallel the Norfolk & Western Railroad.

THE CLEVELAND ELECTRIC RAILWAY COMPANY, Cleveland, has just received a new funeral car which marks an innovation in the methods of conducting burials in this city. The car is of the largest size, divided into two compartments, the forward being used for the reception of caskets while the rear has seats for thirty mourners. The decorations are very rich yet appropriate. The car will run on any of the city or suburban lines, and will greatly decrease the cost of funerals.

THE BURTON, JEFFERSON & ANDOVER RAILWAY COMPANY, which has secured valuable franchises for an electric system in northeastern Ohio, has just secured additional capital and it is proposed to still farther increase the mileage. A new road is being planned from Ashtabu'a to Warren. From Andover an extension is to be built eastward through Meadville, to Erie, Pa. There will also be a branch westward from Andover through Burton to South Newbury, connecting with the Cleveland & Chagrin Falls road, recently completed to that point, thus making a continuous line from Cleveland to Erie. The system will embrace nearly 300 miles of track.

INDIANA NOTES.

Indianapolis, Sept. 23, 1899.

AMERICAN DISTRICT TELEGRAPH COMPANY has applied for a franchise at Fort Wayne, and agrees to pay a percentage on gross earnings for the privilege. The city will ask 3 per cent. after January, 1900, and the company offers 2 per cent. after January, 1901. There is a probability of a satisfactory compromise.

FOREIGN COMPANIES TO GIVE BOND.—The Winchester Bell Telephone Company, which was preparing to make a fight against the local and independent companies at Winchester, received a setback by the passage of an ordinance by the Winchester city council, requiring foreign companies to give bond, with resident sureties, and deposit $500 in cash with the city treasurer.

ELECTRIC STREET CARS NOT BOUND BY ANCIENT ORDINANCE.—In a recent suit brought against the Citizens' Street Railway Company at Indianapolis to recover damages occasioned as alleged by being struck by a street car, which complainant charged was running at a speed in excess of the maximum fixed by a city ordinance passed in 1864, regulating the speed at not more than six miles an hour, Judge Allen instructed the jury to return a verdict for the company, and said that the ordinance in question was fixed in reference to animal power, and not with reference to companies operating electric lines; that in this progressive age electric lines are not bound by ancient and obsolete ordinances.

RESCINDED THE CONTRACT TO LIGHT CITY.—During August the city council of the city of Plymouth authorized the mayor to sign a contract with the Famous Company, of Chicago, for electric light, conditioned that the company was an incorporated one, as claimed by its agent. It was subsequently ascertained that the company was not incorporated at the time the contract was authorized, but that articles were filed on the 5th of September. The agent then wanted the city to contract with the new company, but the council at its last meeting reconsidered its former vote and renewed the contract with Moses W. Simon, owner of the present plant. Mr. Simon is a resident of the city and the people opposed giving the contract to an outside company and the outcome together with Mr. Simon's proposition gives satisfaction.

Lafayette, Ind., Sept. 18, 1899.

MARDI-GRAS FESTIVAL.—Lafayette will hold a Mardi-Gras Carnival from Oct. 8 to 14. The court house square and Main Street will be lighted with 1500 extra electric lights and a searchlight will be operated.

TROLLEYING A TOWPATH.—Effort is being made to purchase the bed and towpath of the old Erie & Wabash Canal for the purpose of an electrical railroad from Fort Wayne to Vincennes. This will run through the Wabash Valley—the richest portion of Indiana. It is claimed that right of way has been secured from Fort Wayne to Lagro, so that the road will be surely built eventually, if not immediately.

A TELEPHONE FACTORY.—Lafayette subscribed a bonus of $10,000 and $40,000 stock in the Sterling Electric Company two weeks ago. The factory building will be ready for operation within 30 days from date with a force of about 200 men. It is intended to organize the company with a capital of $100,000 in a few days. The Lafayette-Harrison Independent Telephone Company uses the Sterling system.

TROUBLE OVER NATURAL GAS.—Owing to the numerous injunctions brought against the pumping of natural gas from the gas field, the prospects are that the cities outside of this field in central Indiana will have poor service this winter. Fuel dealers have taken advantage of this probability in advertising. People who have used natural gas will not go back to dirty coal if they can get a clean substitute. It would seem that here is a field for the electric heater that can be relied on. Wideawake manufacturers may be prompt to avail themselves of the opportunity at once.

WESTERN NEW YORK NOTES.

Niagara Falls, N. Y., Sept. 23, 1899.

MANAGER MORGAN, of the Niagara Gorge Road, is preparing to illuminate the whirlpool rapids by a new method. His idea is to have a number of arc lamps so placed that the light will be evenly distributed over the beautiful waters of the gorge. A trial will be made soon.

MR. A. F. WITMER, of the engineering staff of Wallace C. Johnson, is in the central part of the state doing work in connection with the proposed development of the Empire State Power Company. Paul Voorhees, who has been assistant in the office of Mr. Johnson, has accepted a position with a Philadelphia electrical company, and will move to that city.

THE GLEN HAVEN RAILROAD, running out from Rochester, has been purchased by the new Sodus Bay Railroad Company. The directors would listen to nothing but an outright sale. It will be double-tracked the entire length. This road was built in 1887, and when opened steam was the motive power. A few years ago it was made an electric road, since which time it has been successfully operated.

SCHOELLKOPF INTERESTS.—In the will of the late Jacob F. Schoellkopf, it is provided that the trustees, Arthur Schoellkopf, of Niagara Falls; Jacob F. Schoellkopf, Jr., John L. Romer and George B. Mathews, of Buffalo, and Fred Voegel, Jr., of Milwaukee, shall operate the Niagara Falls hydraulic power canal property for at least 10 years, when they may dispose of the same and distribute the proceeds equally between the children of the deceased.

MARRIAGES.—Mr. Frank Howard Manley, an employee of the Carborundum Company, of Niagara Falls, and Miss Alice Gertrude Weekes were married at the home of Mr. and Mrs. William Parkham Baker, Chilton Avenue, Niagara Falls, a few days ago. Miss Ida Gertrude Owen, daugther of Mr. and Mrs. C. N. Owen, of Niagara Falls, was married to Edgar F. Price, superintendent of the Union Carbide Company's plant at Niagara Falls on Wednesday evening, Sept. 20. They will reside at 625 Buffalo Avenue, Niagara Falls.

General News.

THE TELEGRAPH AND TELEPHONE.

NAVASOTA, TEXAS.—The Navasota Telephone & Construction Company has been formed. Capital stock, $10,000.

RALEIGH, N. C.—The Mebane-Ridgway Telephone Company has been incorporated to construct lines in Alamance, Person, Durham, Orange and Caswell counties.

PERRYVILLE, KY.—The Boyle Citizens' Telephone Company has about 24 miles of telephone line now in operation, and will extend its system over seven or eight counties. C. R. McDowell, Danville, Ky., is one of the incorporators.

FARMVILLE, VA.—The Farmville Telephone Company has been formed for the purpose of operating a telephone line. Capital, $5000. Incorporators, W. E. Anderson, S. P. Vanderslice, W. P. Venaba, E. L. Morris, J. R. Martin, all of Farmville.

WABASH, IND.—The Bell Telephone Company, having about completed its copper metallic long distance line between here and Goshen, has announced a cut of almost one-half in rates charged by the independent telephones between competing points.

PITTSBURG, PA.—The Federal Telephone Company is the name of a proposed corporation which includes Frederick De Land, Charles S. Wise, Joseph C. Forse, Joseph McClure and Daniel O. Barr. A charter has been applied for. It is the intention to consolidate independent companies.

EASTON, PA.—The Tuscarora Telephone Company has been formed for the construction and maintenance of telephone lines. Capital, $50,000. Incorporators, A. G. Scholl, of Mifflintown; J. G. Thompson, of Mexico; I. N. Grubb, of Thompsontown; J. C. Moorhead, of Port Royal; E. A. Gramm, of Ritchfield.

COLUMBIA, S. C.—John Schofield, 493 Greenwich Street, New York; Henry O. Reed, 11 Broadway, New York; Jerome Bradley, 129 Furman Street, Brooklyn, N. Y., and J. A. Helvin, of Charlotte, N. C., have incorporated the South Carolina Telephone Company, for the construction of telephone systems. Capital stock, $50,000.

THE ELECTRIC RAILWAY.

ST. LOUIS, MO.—The St. Louis & St. Charles Railroad Company has been incorporated by J. H. Lucas and others, with a capital of $500,000.

NEWPORT NEWS, VA.—Work has begun double-tracking the line of the Newport News & Old Point Railway & Electric Company in Newport News.

PHILADELPHIA, PA.—The Union Traction Company interests have secured control of the Bucks County Railway Company, and the road will shortly be double-tracked.

MACON, GA.—Work is to begin upon a street car line three miles long, connecting the street railways in Macon with North Highlands across the Ocmulgee River.

DOYLESTOWN, PA.—Track laying and wiring on the Newtown-Doylestown trolley are completed and the operation of the road will begin as soon as the power house is in running order.

MARSHALL, MICH.—Representatives of the Jackson, Albion, Marshall & Battle Creek Street Railway Company have notified the council that the company would accept the franchise prepared by that body. By its terms the road pays $5000 a year to apply on street paving and gives eight tickets for 25 cents. The franchise runs 30 years.

COLUMBUS, OHIO.—The Scioto Valley Traction Company has been incorporated for the purpose of building an electric road from Columbus to Chillicothe, via Circleville. It is capitalized at $100,000. The incorporators are W. F. Burdell, Alexander Renick, Thomas King Wilson, Edward K. Stewart, William J. Weaver, Herbert D. Bennett, all of Columbus.

GALVESTON, TEXAS.—The Galveston City Railroad, which has been in a receiver's hands for the past two years, has been sold to Julius Runge, of Galveston, for $905,000. Mr. Runge is understood to represent the stockholders. The road was bonded for more than $1,100,000. Since being in the receiver's hands it has been greatly improved, a new roadbed built and new rails laid over one-third of the line of 36 miles.

NIAGARA FALLS, N. Y.—The International Traction Company is changing the poles that carry its feed wires through the city between the power house and Echota. The iron poles are being removed from between the tracks and large wooden poles, placed on both sides of the street, are being substituted for them. The wooden poles are similar to those used on the Buffalo & Niagara Falls division of the Traction Company's system and are able to hold a larger cable than the iron poles. This will provide for a larger quantity of current with which to operate the cars between the city line and Riverway.

BIRMINGHAM, ALA.—The Highland Avenue & Belt Railroad, which was bought by Elmer E. Whittaker for $176,000, has been taken over. The steam dummy passenger line has been transferred to the Birmingham Traction Company, which is controlled by James T. Woodward, president of the Hanover National Bank. This line will be immediately equipped with electricity, and form part of the traction system. The Belt Freight Line, the more valuable part of the road, has been incorporated as the Birmingham Belt Railroad Company, with J. B. Cobbs, cashier of the Birmingham Trust & Savings Company, as president. It is stated that this organization is only of a straw nature, and that the property has really been sold to a railroad trunk line, either the Seaboard Air Line or the Louisville & Nashville. It is now evident that all the Birmingham street car lines are to be consolidated, and the most general belief now is that they will be absorbed by the Birmingham Railway & Electric Company.

ELECTRIC LIGHT AND POWER.

NEW IBERIA, LA.—The city will issue bonds for the erection of an electric light plant and construction of water works.

DALTON, GA.—A franchise has been granted to Dr. John W. Green, of Tilton, Ga., for the erection of an electric light plant at Dalton.

PAW PAW, MICH.—In consequence of the lowness of the water in the river, the electric light plant is unable to run, so the town is in darkness.

CHATTANOOGA, TENN.—The narrow gauge railroad company, operating on Lookout Mountain, J. T. Crass, president, will erect an electric power plant.

CHICAGO, ILL.—The Carbondale Lighting Company has been formed for operating an electric light plant. Capital, $15,000. Incorporators, J. R. Hastings, D. I. Sicklesteel, E. Hermes, all of Chicago.

SUMTER, S. C.—The Sumter electric light plant has been purchased for $10,000 by R. O. Purdy, representing the bondholders, C. T. Mason and R. M. Wallace, who will operate the plant and consolidate with it their ice factory.

WAYCROSS, GA.—The Satilla Manufacturing Company will erect a new brick dynamo house and install a 500-hp Corliss engine for increasing its plant so that it will be able to operate all the machinery in its planing mill, as well as other machinery in the city, by electricity.

COLUMBUS, GA.—The big dam which is being erected across the Chattahoochee at North Highlands by the Columbus Power Company is almost completed, and in a short while the new power house will be built. The connecting of the two ends of the dam on the Alabama side of the river has been effected and the current turned to the Georgia side. When completed this plant will be the largest electric power plant in Georgia.

NIAGARA FALLS, N. Y.—A very important piece of work is now being done by the Niagara Falls Power Company. It is the widening and deepening of the inlet to the canal which supplies water for the operation of the big turbines in the wheelpit. A steam dredge and a large force of men have been engaged at the work for several days, and it will be weeks before the job is finished. Less trouble is expected from anchor ice this winter as a result of the work.

AUBURN, N. Y.—The common council of Auburn has let a contract to the electric light company of that city to light the streets for seven years at $70 per lamp per year. The provisions of the contract are that the number of lamps be increased from 300 to 350 with a proportionate increase in all-night lamps, the existing ratio being 1 in 6 4-11; that if the number of lamps be increased to 400, there shall be a reduction of $2 each in the price of all lamps a year, making the rate $68 a year. By making a seven-year contract there would be an annual saving of $1050 as compared with a contract for five years.

LAKEWOOD, N. J.—The plant of the Lakewood Water Company, including its sewerage system and the Lakewood Electric Light Company, has been purchased by a new company, which has been incorporated under the name of the Lakewood Water, Light & Power Company. The new company has been capitalized at $150,000, of which $140,000 has been paid in. Its officers are: President, Frederick R. Drake, of Easton, Pa.; secretary and treasurer, Carroll Ph. Bassett, of Summit; directors, Charles H. Kimball, F. P. Kimball, D. D. Davis, A. D. Davis, William J. Harrison, of Lakewood; Charles H. Payson, of Portland, Me.; Frederick Green and Carroll Ph. Bassett, of Summit, and Frederick R. Drake. The new company will develop an underground water supply from Lake Manetta and Lake Carasaljo, and so abandon the filtration system now in use.

THE AUTOMOBILE.

PORTLAND, ME.—The Eastern Transportation Company has been formed for automobile transportation. Capital, $100,000. Incorporators, Charles H. Gray, of Jackson, N. H.; Edward Preble, of Boston; William Odlin, of Andover, Mass.; George P. Thomas, David E. Murdock, of Portland.

AMESBURY, MASS.—An automobile carriage company has been organized here, with a capital of $150,000, in $25 shares. These temporary officers were elected: President, Joseph T. Clarkson; secretary, Charles F. Worthen; treasurer, Edward R. Brungs. The motive power will be electricity. The promoters of the corporation are all well known carriage builders.

CINCINNATI, OHIO.—At the solicitation of the Waltham Manufacturing Company and other automobile manufacturers in the east, the management of the Mid-Continental Exposition, at Oakley Park, has arranged for a series of automobile races, including the three classes, two-wheel, three-wheel and four-wheel vehicles. The secretary of the Waltham Company assures a large number of entries for each class from eastern states and Cincinnati citizens interested in horseless vehicles have taken hold of the matter and, it is said, will offer a number of special prizes for the races at Oakley Park.

ALLEGHENY, PA.—Automobiles will soon be running in Allegheny as one of the chartered organizations of the city and in direct opposition to the United Traction Company. The refusal of the Traction Company to extend its lines over certain streets of the city led to the movement. Within the next few months a regular line of automobiles will leave the market house, Ohio and Federal streets, and make regular trips through principal streets of the city and into towns on the city borders. Money for the organization of the company has already been subscribed, and a charter will be applied for at once.

NEW COMPANIES.

JERSEY CITY, N. J.—The International Motor Wheel Company has been formed to manufacture motors, etc. Capital, $250,000. Incorporators, Oscar L. Lefferts, Edward B. Hawkins, Frederick W. Garvin.

ERIE CANAL ELECTRIC TRACTION COMPANY.—At a meeting of the stockholders of the Erie Canal Electric Traction Company, held this week, the following directors were elected: Louis A. Von Hoffmann, of the banking house of L. Von Hoffmann & Co.; William Mertens, of the banking house of L. Von Hoffmann & Co.; Henry R. Ickelheimer, of Heidelbach, Ickelheimer & Co.; Hon. Thomas C. Platt, president United States Express Company; Charlton P. Lewis, Mutual Life Insurance Company; Hon. John G. Carlisle, ex-Secretary of the Treasury; Frank W. Hawley, president of the West Indies Telegraph & Cable Company; William H. Baker, vice-president of the Postal Telegraph Company; George W. Balch, New York Produce Exchange; James Virdin, Corporation Trust Company. The following officers have been elected: President, Baron Louis A. Von Hoffmann; Vice-President, Frank W. Hawley; Secretary, A. B. Donaldson.

OBITUARY.

FRANK T. PUGH, a grandson of the late John Stephenson, committed suicide last week by shooting himself with a revolver. His body was found close to the Stephenson brook on the Boston Post road, near Larchmont, N. Y., on the Sound. Daniel W. Pugh, his father, went to New Rochelle to get the body. He declared he knew no reason why his son should have taken his life. He had been happy and hopeful and was bright and clever. Great sympathy with the family is felt.

PROF. ROBERT W. QUICK.—We regret deeply to announce the death of Prof. Quick, from typhoid fever at Atlanta, Ga., where he had charge of the department of physics and electrical engineering in the Technological School. He was about thirty years of age, and leaves a wife in Atlanta and a sister and three brothers in New York State to mourn his loss, besides a host of friends. He married a little over a year ago Miss Marjory Ellis, of Atlanta. He graduated from the Ithaca High School in 1888, and taught in a public school of that city for one year. In 1890 he entered Cornell University on a state scholarship awarded on a competitive examination, and went on record as standing the highest in the state. He was graduated from Cornell in 1894, receiving the degree of bachelor of science. In the fall of the same year, from a large number of applicants, he was chosen to the fellowship in physics at Cornell University, in virtue of which, in addition to the graduate studies, he continued to pursue physics and electrical engineering. He taught physics during 1894 and 1895. During the same time he was president of the electrical society of Cornell University. He was a member of the American Society for the Advancement of Science. He possessed a genial disposition, was an efficient teacher, and his place will be hard to fill in his field of work.

PERSONAL.

PRES. C. A. COFFIN and Mr. F. P. Fish, of the General Electric Company, have both returned home from Europe recently.

MR. ALEX. HENDERSON, who has been suffering from severe rheumatism and was reduced to a wheel chair, is under treatment at Mount Clemens, Mich., with very beneficial results, crutches being discarded already.

MR. S. DANA GREENE, the general sales agent of the General Electric Company, who, with his wife, has been traveling in Holland, Switzerland, etc., for some weeks past, returned on the Aurania on Thursday, Sept. 21, greatly benefited by the well earned holiday.

SIR W. H. PREECE, before the Sanitary Institute at Southampton, as its president, delivered an admirable address, in which he gave Moses a great send-off as a sanitary engineer. He spoke of the six purities—air, water, food, soil, dwellings and bodies, and touched on each, not forgetting the part played by electricity in rendering all possible and attainable.

MR. C. J. FIELD, engineer and contractor, who has for the past year and a half been identified with and interested in the American Vitrified Conduit Company as general manager, has severed his connection with that company to take the position of vice-president and general manager of the United States Motor Vehicle Company, who have opened their offices in the Townsend Building, at Twenty-fifth and Broadway, New York City. Mr. Field also proposes to continue his separate business interests as a consulting engineer and contractor on central station, railway work and underground conduit work.

CLARKE-KOELLE.—Miss Ida Koelle, a daughter of Mrs. George Webb, of Bedford Park, and Mr. William J. Clarke, general manager of the United States Electrical Supply Company, were married at the Congregational Church, Bedford Park, Sept. 20, the Rev. Wayland Spaulding, pastor of the church, officiating. The bride wore a white organdie gown, trimmed with ribbon and Valenciennes lace, and carried a bouquet of bridal roses and ferns. She was escorted by her guardian, Mr. Gustav Berg. Her bridesmaids were her sister, Miss Amy Koelle, and Miss Bertha Van Houdt, of Fordham. The best man was Mr. R. B. Comegys, of Philadelphia. Mr. Ernest Mordstrom and Mr. John Tullock acted as ushers. The church was decorated by the teachers of the Sunday school, of whom the bride was until recently one. A reception at the bride's home, in Briggs Avenue, followed the church service. In going to and from the church the bride rode in an automobile, the first time, it is said, that the horseless vehicle has been used on such an occasion in this city. After a short bridal trip Mr. and Mrs. Clarke will reside on University Heights.

Trade and Industrial Notes.

THE TAYLOR TURBINE.—A catalogue from John W. Taylor, Atlanta, Ga., has for its subject the Taylor sleeve gate turbine water wheel, which in a number of cuts is illustrated and described in detail. In this turbine the gate is a close-fitting sleeve, opening downwardly and closing upwardly. The construction of the wheel is such that the usual turbine multiplicity of parts is obviated, a registering balance is secured which produces sensitive working, leakage and non-efficient water when the gate is lifted are avoided, and a tight gate secured while the wheel is at rest, and there is no churning and friction of dead water in the dome while the wheel is at labor.

RHEOSTATS AND CIRCUIT BREAKERS.—Catalogue No. 997 of the Ward Leonard Electric Company, Bronxville, N. J., has for its object the illustration and description of the principal rheostats and circuit-breakers of that company's manufacture. The variety of these appliances made at the Bronxville factory may be surmised from the fact that between 50 and 75 cuts are necessary merely to illustrate types. Among the appliances shown are field rheostats, field regulators, theatre dimmers, motor-starters, motor speed regulators, storage battery regulators, printing press speed controllers, organ motor controller, reversing controllers and regulators, resistance boxes, and direct and alternating current circuit breakers of various types and for various uses.

SEARCHLIGHTS will be a leading feature in the illuminations in the Dewey celebration this week and the hundreds of powerful beams darting across the sky will produce a much finer effect than could possibly be produced by any amount of fireworks. Anticipating a large demand for projectors for the illuminations the Rushmore Dynamo Works, who make a specialty of this apparatus, early prepared a large number and were able to meet all demands for lights for the city and harbor illuminations. A great many lights have been sold to owners of lofty buildings commanding a view of the harbor and along the course of the land parades. The Rushmore Works have also placed nearly twenty large projectors on the roof of the fourteen story building of the Western Electric Company, at Bethune Street and North River, and this display is expected to eclipse all others.

WIRE TABLES.—A set of well arranged wire tables recently issued by the India Rubber & Gutta Percha Insulating Company, of Yonkers, N. Y., will be found a useful convenience. Among the tables is one giving a comparison of B. & S., B. W. G., S. W. G. and millimeter wire gauges. Another gives for the B. & S. gauge the nearest B. W. G. gauge; the diameter in mils and millimeters; the cross-sections in circular mils, square inches and square millimeters; the resistance in ohms per 1000 feet, per mile and per kilometer; the weight in pounds per 1000 feet and per mile, and in kilogrammes per kilometer; and the amperes for a drop of 2½ volts per 300 feet. The tables of the various Habirshaw insulated wires give the outside diameters in mils, the pounds per mile and kilogrammes per kilometer. The tables of bare stranded conductors give complete data as to number of wires, diameters, cross-sections, weight and resistance and the ampere capacity of the larger sizes. The binding is in cloth boards, and the outer margins of the pages are indexed and cut to enable a desired table to be found at a glance—a feature that will be appreciated in a book of reference. Dr. Habirshaw is much to be complimented on this useful and handy pamphlet.

THE AMERICAN STEEL & WIRE COMPANY, contrary to the impression which might be created by its name, is by no means confined to the production of iron and steel wires or their products. By the absorption of the Washburn-Moen Manufacturing Company, the larger organization inherited one of the world's most important manufactories of bare and insulated copper wires in various forms and for all electrical purposes. With the immense plant at Waukegan, Ill., only thirty-five miles north of Chicago, at which much of the copper wire is produced, the American Company enjoys exceptional facilities for catering to the wants of the trade in the West, giving as it does to their organization the same prestige in occupying the Western field that is enjoyed by the Washburn-Moen Department at Worcester, Mass., in Eastern territory. We make these statements on the assumption that they will be news to many of our readers, the recent changes in the commercial and manufacturing world having been so numerous and kaleidoscopic that many, even among the large users of their products, have not become familiar with the new scope of their operations. In every line of production, certain names come to stand out in bold relief as synonyms for some forms of superiority or for some characteristics of excellence. In the production of electrical wires, bare and insulated, the introduction of improvements calculated to secure best results and in uniformity of excellence, no name has ever stood higher than that of Washburn-Moen. The merging of this company into the American Steel & Wire Company means simply a further step whereby with unlimited resources, continued investigation and improvements and a still greater excellence are assured in the production of all forms of electrical wires, rail bonds, etc. At the Waukegan plant special attention is given to the manufacture of the well known "Extra BB," "BB," and "Steel" telephone and telegraph wires and copper wires for electric lighting and street railway plants in all their various forms; and the system of tests at every stage of the manufacture of these goods is at once so unique and rigid that the high standard set for all the products of this company is always maintained. Purity, conductivity, tensile strength, finish and uniformity to gauge, are all given due attention, resulting in the output of millions of pounds, distributed among all the nations of the earth in the operation of telephone, telegraph and electrical traction systems. In the production of copper rail bonds, either solid or flexible, the prestige of the Washburn-Moen name has been added to since the formation of the American Steel & Wire Company, and the output of solid and flexible "Crown" bonds in a variety of patterns and for adjustment to the rails in various positions has been marvelous. This is equally true of the manufacture and sale of copper trolley wire, in which this company has earned a commanding position. In the department of insulated wires, the entire line, including every form of magnet wire, office and annunciator wire,

weatherproof wire, feeder wires, lead encased wires and cables, and submarine cables is thoroughly covered, the rubber insulating, taping, braiding, lead encasing, armoring and weather proofing being carried on under the supervision of the most expert, scientific skill and experience that can be secured. The general offices of the company are located in "The Rookery," Chicago, with branch offices in New York, Worcester, San Francisco, St. Paul, St. Louis, Cleveland, Denver and other cities.

A NEW CATALOGUE has just been issued by the Electric Appliance Company, Chicago, covering the entire line of Edison, Thomson-Houston and Westinghouse sockets, receptacles, etc. This catalogue illustrates the latest improvements in the socket line. A net price list accompanies the catalogue.

THE REPAIR SHIP VULCAN.—One of the most important problems presented in the equipment of the repair ship Vulcan, of the Santiago fleet, was that of maintaining an endurable atmosphere in the forge shop and foundry, which were located between decks. The problem was solved by introducing a large steam fan and system of piping. This installation, like that in connection with the foundry equipment, was made by the B. F. Sturtevant Company, of Boston. The fan was applied to exhaust the smoke from the forge hoods, and, coincidentally, the hot air from the forge shop. It was stated by the officers in charge that "this arrangement proved of inestimable value."

THE WESTERN ELECTRICAL SUPPLY COMPANY, of St. Louis, on account of the phenomenal increase in their business, have recently been compelled to double their office space, and give each of their various departments a separate office. The change is certainly one for the better, as it not only makes an extremely attractive and businesslike office, but it greatly facilitates the transaction of business. One of the greatest advantages is that you can see at a glance upon entering their general offices where the department with which you have business is located. Realizing that the principal point of a jobber's and manufacturer's success lies in prompt and satisfactory shipments, they have recently taken as a warehouse a building nearly as large as their present one, and are to-day carrying the largest stock of electrical supplies in the west. With their present greatly enlarged facilities they are prepared to ship from St. Louis stock anything pertaining to the electrical supply business, thus avoiding delays that are often expensive and at all times annoying. They have issued a most carefully compiled and complete catalogue for each of their departments, containing the entire line of goods handled by that department. They mail these on application.

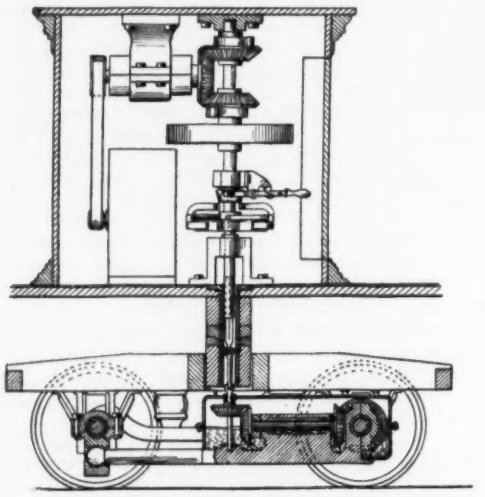
Record of Electrical Patents.

UNITED STATES PATENTS, ISSUED SEPT. 19, 1899.

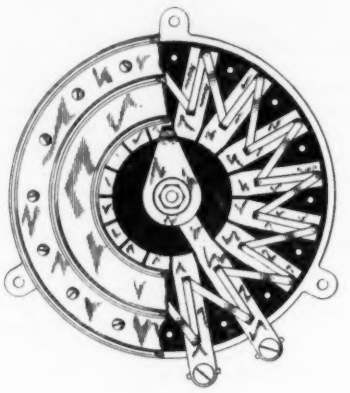
[Compiled by Wm. A. Rosenbaum, 177 Times Building, New York.]

633,146. COMBINED GENERATOR AND RINGER FOR TELEPHONES; J. G. Nolen, Cleveland, Ohio. App. filed June 30, 1898. The invention consists in so combining the generator and ringer mechanisms as to permit of the utilization of the field magnets of the generator as the polarizing magnet for the fields of the ringer, thereby dispensing with the usual separate polarizing magnet.

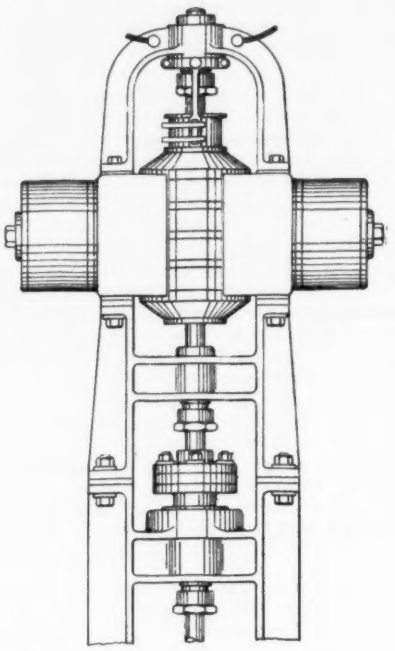
633,164. ELECTRO-THERAPEUTIC BATH; H. Stanger, Ulm, Germany. App. filed July 10, 1899. The bath tub is made trapezoidal in form and carbon electrodes extend along the two converging sides for the full length.



633,385.—Power from Axle.



633,172.—Rheostat.



633,478.—Motor and Pump Head.

633,165. DEVICE FOR FEEDING CURRENT TO ELECTRICALLY DRIVEN POWERS; C. F. P. Stendebach, Leipsic, Germany. App. filed April 1, 1898. The contacts are placed in a chamber sealed by mercury and a crank arm works through the wall of the chamber to make the necessary connections and disconnections with the contact.

633,166. ELECTRIC RAILWAY; C. F. P. Stendebach, Leipsic, Germany. App. filed Sept. 19, 1898. Details of construction of a sectional conductor system.

633,172. RHEOSTAT; C. Wirt, Philadelphia, Pa. App. filed Aug. 7, 1897. The invention comprises a continuous length of electric conductor coiled, folded or otherwise compactly arranged in a number of sections, each containing a suitable length of the conductor and so mounted as to be cut into or out of circuit one at a time.

633,173-6.—INSULATORS; Frederick Henry Withycombe, of Montreal, Canada. Four patents. App. filed Feb. 2, 1899.

633,182. ADJUSTABLE CROSSOVER FOR ELECTRIC WIRES; J. E. Blakesley, Chicago, Ill. App. filed Feb. 20, 1899. The crossover comprises an upper arm having its central portion insulated, a metallic portion secured on the insulated part and a lower arm pivoted or secured between the insulated part of the upper arm and the metallic portion.

633,223. ELECTRO-MEDICAL APPARATUS; W. P. Sutton, Toronto, Canada. App. filed Nov. 25, 1898. A medical coil is mounted upon an insulating base and the bottom of the base is fitted with open sockets in which are anti-friction balls or rollers which come into contact with the surface treated by the apparatus and reduce the frictional contact.

633,240. DEVICE FOR LIGHTING LAMPS BY ELECTRICITY; S. M. Meyer, New York. App. filed Nov. 30, 1898. Batteries placed in the base are connected with a device intended to be operated manually to ignite the wick.

633,249.—METHOD OF FORMING ELECTRODES FOR SECONDARY OR STORAGE BATTERIES; Henri Rathier, of Paris, France. App. filed Oct. 22, 1898.

633,350.—BURNER FOR INCANDESCENT LAMPS; Orlando M. Thowless, of Newark, N. J. App. filed July 23, 1896.

633,385. MEANS FOR TRANSMITTING POWER FROM AXLES TO BODIES OF RAILROAD CARS; L. T. Mann, Chicago, Ill. App. filed Dec. 10, 1898. A shaft which gears with the axle extends through a hollow king-bolt to a generator on the car body; the portion passing through the king-bolt is made in two telescoping parts so that the shaft may be lengthened and shortened with the vertical movement of the body.

633,403. TELEPHONE EXCHANGE SWITCHBOARD SIGNALING APPARATUS; T. C. Wales, Newtown, Mass. App. filed June 23, 1899. Two relays are used, one for each of two connected subscriber circuits; they both control the supervisory signal and are responsive to the action of the switch at the subscriber's station to which they respectively correspond.

633,415. VALVE ACTUATING DEVICE; J. F. Batchelor, New York. App. filed June 14, 1898. This device, which is mostly mechanical, is a valve by which steam may be cut off in case of accident; an electromagnet is arranged to operate the valve.

633,478. COMBINED ELECTRIC MOTOR AND PUMP HEAD; R. F. Northam and G. E. Nolan, Los Angeles, Cal. App. filed Dec. 20, 1898. The pump and motor shafts are mounted in the same frame to which also the motor is attached.

633,494. ELECTRIC RAILWAY SIGNAL; J. Shoecraft, Topeka, Kan. App. filed Nov. 21, 1898. Details of two interlocking relays are used to control the signal, the circuits being operated by the trains.

633,547. TELEPHONE SYSTEM; M. M. Davis, Chicago, Ill. App. filed Feb. 6, 1899. A peculiar winding and connection for the annunciator magnets, the object in view being to prevent false signals.

SYNOPSIS OF CONTENTS

IN

SPANISH, FRENCH AND GERMAN.

Resúmen de los Articulos.

DRAGAS ELECTRICAS PARA EL RIO VOLGA RUSIA. (Página 517.)

Descripción de un tipo de draga empleando electricidad en gran escala para su operación. La draga es construida en dos partes, midiendo cada una 216 piés de largo por 31½ piés de profundidad siendo el tiro ó corriente, en su completa carga, de 4 piés y 8 pulgadas. Cada parte contiene un generador de 600 Kw. directamente conexionado á una máquina de triple expansión. Para la propulsión hay cuatro motores eléctricos de 125 caballos de fuerza cada uno, dos en la proa y dos en la popa con tornillos de impulsion propulsores. Hay dos motores eléctricos de 30 caballos de fuerza cada uno montados en el pontón estando directamente acoplados á los ejes del hélice conduciendo tres palas de remo propulsores de 20 pulgadas. Todos estos motores son del tipo de indución de tres fases, tomando la corriente á 550 volts y de una frecuencia de 40 períodos por segundo. El alambre en uso para regularizar los motores propulsores de la draga, está enrollado en una tuberia de bronce de 42 piés de largo, por la cual el agua pasa por medios de una bomba impulsada eléctricamente afin de conservar la temperatura dentro de sus propios límites. La resistencia es dividida en ocho partes iguales y arrojada dentro y fuera del circuito por medios de un registrador en la casilla del piloto. Los motores del pontón tienen una resistencia fija en la armadura del circuito y sus velocidades están sujetas á la variación del voltage de la corriente abastecida por medios de un transformador ó compensador variable colocado tambien en la casilla del piloto. Las luces eléctricas son abastecidas por una planta generante separada consistiendo de un juego de marina generante de 15 Kw. el que provée tambien una corriente excitante para el generador de tres fases. La iluminación es abastecida por 60 lámparas incandescentes y hay una luz exploradora en el puente.

PLANTAS O EDIFICIOS ELECTRICOS EN LAS ISLAS SANDWICH. (Página 521.)

Descripción de plantas ó edificios públicos de alumbrado de Hawaii. dos de las cuales están en Honolulú y la tercera en Hilo. Una de las primeras es del gobierno con fuerza motriz de agua, solamente para el alumbrado de calle, y la otra, ademas del servicio de su ciudad, transmite la corriente para el alumbrado y fuerza motriz á edificios de la vecindad. La planta de Hilo, en una icudad de 3500 habitantes, la mayor parte naturales, no usando la luz eléctrica, conduce una carga de noche de 3000 lámparas incandescentes de 16 candelas de fuerza y durante el dia abastece una corriente de 200 caballos de fuerza de motores de inducción. En la actualidad, la planta está en procedimiento de ampliación cuya nueva fuerza motriz proviene de una caida de agua teniendo una cabeza ó manantial de 1060 piés. Se ha organizado, en Honolulú, una Compañia de Automobiles y ahora está construyendo una estción de carga que contendria dos generadores de 60 Kw. á 110 volts.

ELECTRICIDAD PARA SANEAMIENTO EN LA HABANA. (Página 525.)

Descripción de una planta ó edificio para la producción eléctrica por el procedimiento de hipocloritos de Woolf's "Electrozone." Por este método el agua del mar es electrolizada, resultante de la formación de varios hipocloritos cuyos son unos desinfectantes poderosos. Hay ocho tanques electrolizadores de una capacidad de 100,000 galones diarios de agua del mar. La corriente es producida de dinamos cada uno de los que tiene una capacidad de 4500 amperes á 6 volts. Los eléctrodes positivos ó atacables son de una liga de platino é iridio el que no es afectado por el cloro nasciente desarrollado en este polo. El agua del mar cargada así con hipocloritos, es usada para desinfectar las calles y está propuesto para que produzca, en gran escala, la purificación de la bahia. La notable innumidad de la Habana para la Fiebre Amarilla, durante la última estación, es grandemente atribuida al empleo de este método de desinfección.

PLANTA ELECTRICA AMERICANA EN FRODINGHAM, INGLATERRA. (Página 524.)

Una planta instalada por la Westinghouse Company en los talleres de la Frodingham Steel and Iron Company, Lincolnshire, Inglaterra. El generador tiene una capacidad de 150 Kw. á 250 volts. Tres motores de 50 caballos de fuerza sirven para impulsar y transmitir los rodillos de las mesas y conducir hierro en el procedimento de la manufactura de máquina á máquina. Dos motores de la misma fuerza motriz impulsan los conductores cuyos transfieren los pedazos de hierro en bruto de una mesa á la otra. Un motor de 35 caballos de fuerza impulsa una mesa de carga cuya anda de arriba abajo al frente de un número de hornos recalentados; otro motor, de indéntica fuerza motriz, está situado en la misma mesa y por medio de un arreglo de unas uñas ó garras pueden conexionarse á un juego de rodillos adjuntos ó á la grúa manipulante. Los registradores son del tipo ferro-carrilero eléctrico, permitiendo rápidas paradas y prontos contra-vapores. Tienen un largo número de marchas cuyas dan una regulación ajustada con poco arqueo. Los motores, en la mesa de rodillos, son impulsados por un engrane de rosca, cuyos marchan con aceite en una caja cerrada.

GENERADORES PARA FUNDIR. (Página 525.)

Una descripción ampliamente detallada de un tipo de generador para fundir hecho para la Crocker-Wheeler Company por la Smelting Corporation de Ellesmere Court, Inglaterra. Las màquinas son de 450 Kw. de capacidad y de 250 volts, y su velocidad es de 100 revoluciones por minuto. Las séries de carretes-boblares son de tirillas de bronce y los carretes-boblares de desviación son de alambre. La armadura tiene un ánima dentada y ventilada en forma de carretes-boblares enrollados. El área de la escobilla es sobre la base de 30 amperes por pulgada cuadrada. El diámetro de la armadura es de 87 pulgadas y el del conmutador de 67 pulgadas. El peso de la armadura es de 13 toneladas y el peso total de cada máquina de cerca 32 toneladas.

AUTOMOBILES. (Páginas 532, 552 y 553.)

Describense y se ilustran tres nuevos tipos de automobiles. Uno de ellos es el wagón eléctrico de hacer entregas, de Wood, con una capacidad de carga de 1500 libras y un derecho de peage por milla de 25 en una batería de carga á una velocidad máxima de 10 millas por hora. Este vehiculo ascenderá, con carga completa, una pendiente de 6 por ciento. Usanse 40 celdas de batería. El caromato eléctrico de Riker, pesa 10,000 libras y tiene una capacidad conductora de 6 toneladas, siendo sus velocidades de 2, 3 y 6 millas por hora. Las baterías pesan 3000 libras y cada carga es suficiente para un viaje de 20 millas. Hay engranados á las ruedas de atrás, dos motores de diez caballos de fuerza cada uno. Usanse llantas de 4 pulgadas de goma sólida.

NUEVO TIPO DE MAQUINA MOVIDA POR EL GAS. (Página 543.)

Una descripción en detalle del nuevo tipo de la máquina movida por el gas de Westinghouse, de las cuales hay varias actualmente en operación de una capacidad de 650 caballos de fuerza, la mayor máquina movida por el gas que jamás se haya hecho. En su apariencia externa el tipo se parece á la bien conocida máquina de vapor de simple acción de Westinghouse, teniendo cilindros verticales y una caja con un manúbrio impermeable. En esta máquina hay una explosión en cada ciclo y el montante de la carga es variada para corresponder á las necesidades de su peso y velocidad, sin embargo de permanecer invariables las proporciones de gas y aire en la explosión. Con la añadidura de un Gasificador, la máquina puede andar con Gasolina como combustible.

NOVEDADES ELECTRICAS EN LA CELEBRACION DE DEWEY EN NUEVA YORK. (Página 531.)

Una de las novedades en la celebración de Dewey, fué el uso del alumbrado eléctrico para propósitos decorativos, habiéndose empleado, para ellos, varios miles de fuerza motriz caballar de eléctrica energia. En el puente de Brooklyn, fueron arregladas ocho mil lámparas de 16 candelas de fuerza para sacar á relucir las palabras "Bienvenido Dewey." Las lámparas fueron arregladas en séries de cinco en un circuito de 500 volts.

ARTICULO DE LITERATURA DE CORRIENTE ELECTRICA. (Página 535.)

Una revista semanal de literatura de corriente eléctrica y periódica del mundo. Los artículos importantes contenidos en los principales periódicos publicados en Ynglés, Alemán, Francés é Ytaliano y, completamente ó en parte dedicados á asuntos eléctricos dánse en abstracto, lo propio que el de otros de procedimientos eléctricos tambien, asicomo de sociedades profesionales y corporaciones doctas, etc.

LOS MERCADOS ELECTRICOS EN EL EXTREMO DEL ESTE. (Páginas 522 y 526.)

Los mercados eléctricos del extremo del Este con respecto á los negocios eléctricos de exportación. El escritor de un artículo, el Profesor F. B. Crocker de la Universidad de Columbia y miembro de la Crocker-Wheeler Electric Company ha recientemente regresado de un viaje alrededor del mundo por la via del Japón, China, las Filipinas y la India, dando sus impresiones concernientes al comerico eléctrico con esos países. Crée que los mismos están en vísperas de grandes desarrollos en las aplicaciones eléctricas, particularmente en las eléctricas asicomo de las de transmisión de energia de fuerzas motrices de agua. El alumbrado eléctrico debiera tambien hallar grande expansión debido á su deseo en países cálidos y es lo mismo una verdad con respecto á los abanicos eléctricos. Mucha es la fuerza que se impone ante la necesidad de proveer los deseos y costumbres de la gente conservadora del Este, quienes tienen raices profundamente arraigadas concerniente á las formas, tamaños y aun en los colores de los artículos que necesitan y cuyos caprichos ó antojos, como clientes, debieran ser complacidos. La manera en que los artículos son envasados hace tambien una gran diferencia para que sean aceptados en su mercado. Un segundo artículo sobre el mismo asunto es de la pluma del Señor W. J. Johnston, antiguamente propietario del "Electric World" y por un cuarto de siglo un publicista eléctrico. Se saca en consecuencia un contraste entre el Japonés y el Chino con respecto á sus cualidades comerciales cuyas, por destino, favorecen á los últimos.

GENERADORES ALTERNANTES PARA EL SERVICIO DIRECTO. (Página 529.)

Un articulo por el Señor Alton D. Adams favoreciendo el uso de la corriente alternante para la operación de factorias ó talleres de construcción. Dice que los generadores alternantes de boja frecuencia son baratos de construir, mas fáciles de cuidar y tienen una baja tasa de depreciación que las máquinas de corriente directa. Dáse una breve descripción de ia planta de la corriente directa para el taller de máquinas de la New York Navy Yard adonde se distribuirán 2000 caballos de fuerza para hacer marchar la maquinária. No se usan transformadores siendo la corriente generada y usada á 220 volts.

NOTICIAS APUNTES CORRIENTES. Página 533.)

En este departamento, ademas de las noticias corrientes y apuntes de miscelánea, dánse abstractos de las patentes importantes de la semana. Estas últimas, en este número, incluyen una descripción de una nueva unión eléctrica de riel ferro-carrilero; un metro de tres fases hora-watt; un filamento de una nueva lámpara incandescente; un nuevo método de formar planchas para las baterias de depósito; un polo aislador; un procedimiento para la manufactura de alambre compuesto; una retranca electro-magnética de fricción para motores de fase-poligona; el tiempo-elemento del reótomo, segun se usa en los circuitos del Niágara; una nueva devanadera de fase-poligona; un compensador con circuito de una nueva corriente alternante; detalles del generador del Niágara con imán de influencia magnética y un nuevo tipo de un anillo-colector de corriente alternante.

INTELIGENCIA FINANCIERA Y COMERCIAL. (Página 554.)

En este departamento se dá una sinópsis de la corriente eléctrica de las operaciones financieras y comerciales, estas últimas siendo una detallada revista comercial de la semana.

Table des Matières.

DRAGUES ELECTRIQUES POUR LE VOLGA, EN RUSSIE. (Page 517.)

C'est la description d'un type de dragues pour l'operation de laquelle on employe largement l'électricite. La drague est construite en deux parts, chacune mesurant 216 pieds de long par 31 pieds et demi de profondeur: le tirant d'eau à chargement complet est de 4 pieds 8 pouces. Chacune des parties contient un générateur de 600 kw. en connexion directe avec une machine à triple expansion. La propulsion de la drague est assurée par quatre moteurs électriques, chacun de 125 chev., deux à l'avant, deux à l'arrière, et actionnant des hélices. Deux moteurs électriques de 30 chev. chacun, sont montés sur le ponton: ils sont directement accouplés à des arbres actionnant des hélices à trois ailes de 20 pouces. Tous ces moteurs sont du type à induction trois phasé, recevant du courant à 550 volts et d'une fréquence de 40 périodes par seconde. Le fil usé pour érsistance en réglant les moteurs de propulsion de la drague est enroulé sur un tuyau de cuivre long de 42 pieds, dans lequel une pompe actionnée par l'électricité fait passer de l'eau pour tenir la température dans de propres limites. La résistance est divisée en huit parts égales; on la fait entrer dans le circuit ou bien on l'en rejette au moyen d'un contrôleur qui se trouve dans la cabine du pilote. Les moteurs du ponton ont une résistance fixe dans le circuit, et leur vitesse est controlée en variant le voltage du courant fourni, ce qui se fait au moyen d'un transformeur variable, ou compensateur, qui se trouve également dans la cabine du pilote. La lumiere électrique est fournie par un appareil générateur séparé consistant d'un générateur marin complet de 15 kw. qui fournit aussi le courant excitatif pour le générateur trois-phasé. L'illumination est fournie par 60 lampes incandescentes et le pont est fourni d'un projecteur électrique.

USINES POUR LA PRODUCTION DE L'ELECTRICITE AUX ILES SANDWICH. (Page 521.)

C'est la description de trois usines d'éclairage d'Hawaii, dont deux sont a Honolulu et la troisième à Hilo. L'une des premières appartient au gouvernement, emploie l'eau comme force motrice et ne sert qu'à l'éclairage des rues. La seconde, outre son service de ville, transmet du courant pour éclairage et force motrice aux plantations du voisinage. L'usine d'Hilo, dans une ville de 3500 habitants, la plupart indigènes qui ne se servent pas de lumière électrique, supporte chaque nuit une charge de 3000 lampes incandescentes de 16 bougies, et fournit, pendant le jour du courant à des moteurs d'induction de 200 chev. L'usine est à present en voie d'agrandissement; la nouvelle force motrice sera derivée d'une chute d'eau de 1060 pieds. A Honolulu on a organise une compagnie d'automobiles qui construit actuellement une station de chargement qui contiendra deux générateurs de 60 kw. et ve 110 volts.

ELECTRICITE POUR L'ASSAINISSEMENT DE LA HAVANNE. (Page 525.)

C'est la description d'une usine pour la production électrique d'hypochlorites par le procédé Woolf ou d'electrozone. Par cette méthode l'électrolyse de l'eau de mer resulte en la formation de divers hypochlorites qui sont de puissants desinfectants. Il y a huit cuves à électrolyser d'une capacité de 400,000 litres d'eau de mer par jour. Le courant provient de dynamos dont chacune a une capacité de 4500 ampères à 6 voltes. Les électrodes positives ou attaquables sont faits d'une alliage de platine et d'iridium qui n'est pas affecté par le chlorine nascent développé à ce pole. Ou se sert de l'eau de mer ainsi chargée d'hypochlorites pour desinfecter les rues, et on se prôpose de la produire sur une grande échelle pour purifier le port. Ou attribue largement à ce mode de désinfection l'immunité remarquable de fiévre jaune dont à joui la Havanne durant la saison passée.

APPAREIL ELECTRIQUE AMERICAINE A FRODINGHAM, ANGLETERRE. (Page 524.)

C'est une appareil installée par la Westinghouse Company dans les usines de la Frodingham Steel and Iron Company, Lincolnshire, Angleterre. Le générateur à une capacite de 150 kw. à 250 volts. Trois moteurs de 50 chev. servent à faire mouvoir des tables roulantes de transport qui, au cours de la manufacture, charient du fer de machine à machine. Deux moteurs de la même force meuvent les convoyeurs qui transfèrent le fer brut d'une table à l'autre. Un moteur de 35 chev. meut nue table de chargement qui va et vient devant un nombre de fournaises de rechauffe; un autre moteur de la même force est placé sur la même table et au moyen d'un arrangement de griffes peut être mis en connexion avec un jeu de rouleaux qui s'y trouvent, ou avec la grue de maniement. Les contrôleurs sont du même type que ceux des tramways électriques, ce qui permet des arrêts rapides et de prompts renversements. Ils ont un grand nombre d'arrêts de résistance ce qui donne une régulation serrée avec peu de production d'arc. Les moteurs des tables roulantes les font mouvoir au moyen de roues taraudées et dentées, qui se meuvent dans une boite à huile.

GENERATEUR POUR LA FONTE DES MINERAIS. (Page 527.)

C'est une description détaillée d'un type de générateur pour la fonte des minerais manufacturé par la Crocker-Wheeler Company pour la Smelting Corporation of Ellesmore Court, Angleterre. Les machines sont d'une capacité de 450 kw. et 250 volts, la vitesse étant de 100 révol. p. min. Le jeu de bobines est fait en bandes de cuivre et les bobines mobiles en fil de cuivre. L'armature a un centre denté et ventilé avec une bobine enroulée en forme. La surface des brosses est établie sur une base de 30 ampères par pouce carré. Le diamètre de l'armature est de 87 pouces et le commutateur de 67 pouces. Le poids de l'armature est de 13 tonnes et le poids total de la machine d'environ 32 tonnes.

AUTOMOBILES. (Pages 532, 552 et 553.)

Nous donnons la description et des illustrations de trois nouveaux types américains d'automobiles. L'un d'eux est le camion électrique de Wood, pouvant charsier 1500 livres et pouvant parcourier 25 miles à une vitesse maxima de 10 miles à l'heure, sans recharger sa batterie. Ce véhicule peut monter, avec un chargement complet, une peute de 6 pour cent. Il comporte une latterie d'accumulateurs de 40 piles. Le truck électrique Riker pése 10,000 livres et peut porter 6 tonnes, les vitesses étant de 2, 3 et 6 unites par heure. Lès accumulateurs pésent 3000 livres et chaque charge suffit pour un trajet de 20 miles. Deux moteurs de 10 chev. chacum actionnent les roues de devière au moyen de roues dentées. Les pneut sout en caoutchoue solide et ont 4 pouces d'épaisseur.

NOUVEAU TYPE DE MACHINE A GAS. (Page 543.)

C'est lo description detillée du nouveau type de machine à gas Westinghouse. Il y a en opération, actuellement plusieurs de ces machines d'une capacité de 650 chevaux, qui sont les plus grandes machines à gas jamais construites. En apparence extérieure ce type ressemble à la machine à vaper à simple action Westinghouse qui est bien connue; comme elle, elle a des cylindres verticaux et une boite à manivelle imperméable à l'eau. Dans cette machine, il y a toujours une explosion a chaque cycle, et la quantité de la charge est proportionelle au chargement et à la vitesse, la proportion d'air et de gas, dans l'explosion, demeurant cependant invariable. Avec l'addition d'un gasifieur, on peut employer cette machine en se servant de gasoline comme combustible.

EMPLOI DE L'ELECTRICITE POUR LA RECEPTION DE L'AMIRAL DEWEY A NEW YORK. (Page 531.)

Un des points principaux des fètes en l'honneur de l'Amiral Dewey a été l'emploi de l'éclairage électrique comme décorations. On a employé à cet effet de l'énergie électrique qui se monte à plusieurs milliers de cher. Sun le pont de Brooklin hint mille lampes incandescentes de 16 lougies étauient arrangées de manière à produire les mots "Welcome Dewey." Ces lampes étaient arrangées par séries de cing sur un circuit de 500 volts.

RESUME DE LITTERATURE COURANTE SUR DES TOPIQUES D'ELECTRICITE. (Page 535.)

C'est une revue hebdomadaire de l'entière littérature périodique du monde entier ayant trait à des sujets d'électricité. Les articles importants contenus dans les revues principales publiées en anglais, allemand, français et italien, et dévouées entièrement ou en partie à des études électriques, sont traités en abrrégé ainsi que les procédures des sociétés professionelles, corps savants, etc.

LES MARCHES A ELECTRICITE DANS L'EXTREME ORIENT. (Pages 522 et 526.)

C'est une étude de la situation dans l'extréme Orient en ce qui concerne les affaires d'exportation électrique. L'auteur de l'un des articles, le Professeur F. B. Crocker de l'Université de Colombie et un membre de la Crocker-Wheeler Electric Company, est récemment revenu d'un voyage autour du monde par la route du Japon, de la Chine, des iles Philippines et de l'Inde; il donne ses impressions en ce qui concerne le commerce de l'électricité avec ces pays. Il croit que ces pays sont à la veille d'un grand développement en ce qui concerne les applications électriques, particulièrement la traction électrique et la transmission électrique de l'énergie des chutes d'eau. L'éclairage électrique devrait aussi beaucoup se développer à cause de ses avantages dans les pays chauds, et il en sera de même des évantails électriques. L'auteur fait beaucoup ressortir l'importance de pourvoir aux désirs et aux coutumes des populations conservatrices de l'Orient qui ont des idees profondément enracinés sur la forme, les dimensions et même la couleur des articles dont elles se servent; il faut savoir se prêter aux fantaisies de ces nouveaux clients. La manière dont ils sont emballés fait aussi une grande difference sur la manière dont les articles se vendent. Un second article sur le même sujet est de la

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plume de M. W. J. Johnston, ancien propriétaire de "Electrical World" et pour un quatre de siecle un publiciste électricien. Il établit une comparaison entre les qualités commerciales des Japonais et des Chinois, comparaison toute en la faveur des Chinois.

GENERATEURS ALTERNATIFS POUR SERVICE DIRECT. (Page 529.)

C'est un article par M. Alton D. Adams qui favorite l'emploi du courant alternatif pour l'opération des usines. Il dit que les générateurs alternatifs de basse fréquence sont meilleur marché à construire, d'un entretien plus facile et d'une dépréciation plus petite que les machines directes. Il donne une courte description d'un appareil à courant alternatif pour l'atelier des machines des chantiers de la Marine à New York où une force de 2000 chev. sera distribüee pour faire marcher les machines. On ne se sert pas de transformeurs, la génération et l'usage du courant ayant lieu à 220 volt.

NOUVELLES ET NOTES COURANTES. (Page 533.)

Dans cette partie, figurent, outre les nouvelles courantes et les notes diverses un résumé des brevets importants de la semaine. Parmi cet derniers, ce numéro contient une description d'un nouveau joint de rail pour tramways électriques; une mesure trois-phasée watt heure; un nouveau filament pour lampe incandescente; une méthode nouvelle pour former des plaques d'accumulateurs; un isolateur de pôle; un procédé pour la manufacture de fil composite; un frein à friction électromagnétique pour moteurs polyphases; un interrupteur de circuit à élémenet de temps, comme on s'en sert sur les circuits du Niagara; un nouvel enroulement polyphasé; un nouveau compensateur de circuit pour courant alternatif; des détails sür le générateur à aimant inducteur du Niagara et un nouvel anneau collecteur de courant alternatif.

NOUVELLES FINANCIERES ET COMMERCIALES. (Page 554.)

Dans cette partie nous donnons une synthéte des opérations courantes du monde financier et commercial intéresse en matières électriques et constituant une revue commerciale complète de la semaine.

Inhalts-Verkürzung.

ELEKTRISCHE BAGGERMASCHINEN FUER DEN WOLGAFLUSS, RUSSLAND. (Seite 517.)

Beschreibung des Typus' einer Baggermaschine, bei deren Benutzung Elektrizität in ausgedehntem Maasse zur Verwendung gelangt. Die Baggermaschine ist aus zwei Theilen konstruirt, wovon jeder ca. 65 m lang bei 9,5 m tief ist, und beträgt ihr Tiefgang bei voller Belastung 1,4 m. Jeder Theil enthält eine Stromerzeugungsmaschine von 600 kw, die mit einer Dreifach-Expansionsmaschine direkt gekuppelt ist. Zur Fortbewegung dienen vier elektrische Motoren von je 125 PS, von denen sich zwei im Bug und zwei im Stern befinden und Schiffsschrauben treiben. Zwei elektrische Motoren von je 30 PS sind auf dem Ponton montirt und mit Schraubenwellen, welche 20zöllige, mit drei Flügel versehene Schrauben treiben, direkt gekuppelt. Alle diese Motoren sind solche des Dreiphasen-Induktionstypus' und entnehmen Strom zu 550 Volt und einer Frequenz von 40 Perioden pro Secunde. Der Draht, welchen man für Widerstände beim Reguliren der treibenden Motoren der Baggermaschine benutzt, ist auf eine fast 13 m lange Kupferröhre gewickelt, durch welche man mittelst einer Pumpe, die durch Elektrizität getrieben wird, Wasser hindurchleitet, um die Temperatur in richtigen Grenzen zu halten. Der Widerstand ist in acht gleiche Theile getheilt und wird mittelst eines Kontrollers in dem Steuerhäuschen ein- und ausgeschaltet. Die Ponton-Motoren weisen einen festen Widerstand in dem Ankerstrom auf, und wird ihre Geschwindigkeit durch Aenderung der Voltanzahl des Stroms, der mit Hülfe eines veränderlichen Umformers oder Kompensators geliefert wird, kontrollirt; der letztere befindet sich ebenfalls in dem Steuerhäuschen. Die elektrischen Lichter werden von einer besonderen Stromerzeugungs-Anlage, die aus einem Marine-Maschinensatz besteht, gespeist; dieser Maschinensatz liefert auch Erregerstrom für die Dreiphasen-Dynamomaschine. Die Beleuchtung geschieht durch 60 Glühlampen, und befindet sich ausserdem ein Scheinwerfer auf der Brücke.

ELEKTRISCHE ANLAGE AUF DEN SANDWICH INSELIN. (Seite 521.)

Beschreibung der drei öffentlichen Beleuchtungsanlagen von Hawaii, von denen sich zwei in Honolulu und die dritte in Hilo befinden. Die eine der erstgenannten ist eine Regierungs-Wasserkraftanlage und nur für Strassenbeleuchtung berechnet, während die andere — ausser dass sie die Stadt versorgt — Strom für Beleuchtungs- und Kraftzwecke auch auf benachbarte Plantagen überträgt. Die Anlage in Hilo, einer Stadt von 3500 Einwohnern, die meist Eingeborne sind und kein elektrisches Licht benutzen, trägt zur Nachtzeit eine Belastung von 3000 16 NK-Glühlampen und liefert bei Tage Strom zu 600 PS für Induktions-Motoren. Momentan ist man mit der Erweiterung der Anlage beschäftigt, um die neue Kraft von einem Wasserfall, der ein Gefälle von ungefähr 325 m aufweist, herleiten zu können. In Honolulu hat sich eine Automobil-Gesellschaft organisirt und nunmehr mit dem Bau einer Ladestation, die zwei Stromerzeugungs-Maschinen von je 60 kw und 110 Volt enthalten soll, begonnen.

ELEKTRIZITAET FUER SANITAETSZWECKE IN HAVANA. (Seite 525.)

Beschreibung einer Anlage behufs Produzirung von Hypochloriten auf elektrischem Wege mittelst des Woolf'schen oder „Elektrozon"-Prozesses. Durch dieses Verfahren wird Seewasser durch den elektrischen Strom zersetzt, was die Bildung mannigfacher Hypochloriten, die stark wirkende Desinfektionsmittel sind, zur Folge hat. Vorhanden sind acht Behälter, worin die Zersetzung vorgenommen wird, und können in denselben täglich 100,000 Gallonen (= 4400 Hektoliter) Seewasser auf diese Weise zersetzt werden. Den Strom erzeugen Dynamomaschinen, von denen jede eine Leistungsfähigkeit von 4500 Ampèren zu 6 Volt besitzt. Die positiven oder angreifbaren Elektroden sind aus einer Platin- und Iridium-Legirung, die durch das entstehende Chlorgas, welches sich an jenem Pole entwickelt, nicht affizirt werden. Das Meerwasser, welches auf diese Weise mit Hypochloriten versehen wird, benutzt man zum Desinfiziren der Strassen; auch geht man mit dem Plane um, es in grossem Maasstabe für die Reinigung des Hafens herzustellen. Dass die Stadt während des verflossenen Sommers merkwürdiger Weise vom gelben Fieber befreit blieb, wird zum grössten Theil der Anwendung dieses Desinfektions-Verfahrens zugeschrieben.

AMERIKANISCHE ELEKTRISCHE ANLAGE IN FRODINGHAM, ENGLAND. (Seite 524.)

Eine von der „Westinghouse Company" in den Werken der „Fordingham Steel and Iron Company", Lincolnshire, England, installirte Anlage. Die Stromerzeugungsmaschine besitzt eine Leistungsfähigkeit von 150 kw zu 250 Volt. Drei 50pferdige Motoren dienen dazu, um Transport-Rolltische, die das Eisen bei den verschiedenen Fabrikationsverfahren von Maschine zu Maschine befördern, zu treiben. Zwei Motoren derselben Leistung treiben die Konveyors, welche Eisenblöcke von einer Plattform auf die andere überführen. Ein Motor von 35 PS treibt einen Beschickungstisch, der vor einer Anzahl Schweissöfen rückwärts und vorwärts läuft; ein anderer Motor, der dieselbe Leistung entwickelt, ist an demselben Tische plazirt und kann mittelst einer Klauenvorrichtung mit einem daran befindlichen Rollensatze und mit dem Arbeitskrahn verbunden werden. Die Kontroller sind von demselben Typus wie die an elektrischen Bahnen und gestatten ein schnelles Anhalten und prompte Gegenschaltung; sie weisen eine Menge Widerstandsstufen auf, die eine genaue Regulirung mit geringer Lichtbogenbildung gewähren. Die Rolltisch-Motoren treiben mittelst Schnecken- und Zahnradgetriebe, die in einem geschlossenen Gehäuse in Oel laufen.

DYNAMOMASCHINEN ZUM SCHMELZEN. (Seite 527.)

Eingehende Beschreibung des Typus' eines von der Crocker-Wheeler Company für die Schmelzwerke von Ellesmere Court, England, angefertigten Schmelz-Generators. Die Maschinen haben eine Leistungsfähigkeit von 540 kw und 250 Volt, und beträgt deren Geschwindigkeit 100 Umdrehungen in der Minute. Die Serienspulen sind aus Kupferstreifen und die Nebenschlusspulen aus Draht. Der Anker besitzt einen gezahnten und ventilirten Kern mit formgewundenen Spulen. Die Bürstenfläche beläuft sich an der Basis auf 30 Ampères pro 2,5 cm^2. Der Durchmesser des Ankers beträgt 217,5 cm und der des Stromwenders 167,5 cm. Das Gewicht des Ankers ist 13 t, und das Gesammtgewicht jeder Maschine ca. 32 t.

AUTOMOBILEN. (Seiten 532, 552 und 553.)

Drei neue amerikanische Automobiltypen werden beschrieben und durch Abbildungen veranschaulicht. Eines derselben ist ein Wood'scher Ablieferungswagen, der eine Belastung von mehr als 680 kg tragen und bei einmaligem Laden eine Strecke von 40,22 km bei einer maximalen Fahrgeschwindigkeit von 16,09 km per Stunde zurücklegen kann. Dieses Gefährt ist im Stande, Steigungen von 6 Prozent mit voller Ladung zu überwinden. Zur Verwendung kommen 40 Batteriezellen. Der Riker'sche elektrische Rollwagen wiegt ungefähr 4540 kg und besitzt eine Tragkraft von 6 t, und sind die Fahrgeschwindigkeiten ca. 3,20, 4,80 und 9,65 km per Stunde. Die Batterien wiegen annähernd 1365 kg, und genügt jede Ladung für eine Fahrt von etwas mehr als 32 km. Zwei Motoren von je 10 PS greifen mit Hülfe eines Zahnradgetriebs in die hinteren Räder ein. Man benutzt 10 cm starke, solide Gummireifen.

NEUER TYPUS EINER GASMASCHINE. (Seite 543.)

Ausführliche Beschreibung des neuen Typus' einer Westinghouse Gasmaschine, der grössten Gasmaschine, die jemals gebaut ist, und wovon jetzt mehrere mit einer Leistungsfähigkeit von 650 PS in Betrieb sind. Seinem äusseren Aussehen nach gleicht dieser Typus der wohlbekannten Westinghouse einfach wirkenden Dampfmaschine und besitzt vertikale Cylinder nebst einem wasserdichten Kurbelgehäuse. Bei dieser Maschine findet jeden Cyclus eine Explosion statt, und ist der Betrag der Ladung, um den Anforderungen der Belastung und Geschwindigkeit zu entsprechen, verschieden, wobei jedoch das Verhältniss von Gas und Luft bei der Explosion unverändert bleibt. Durch Hinzufügung eines Gasverwandlungs-Apparats vermag man die Maschine auch mit Gasoline als Brennmaterial in Betrieb zu setzen.

HERVORRAGENDE LEISTUNGEN AUF DEM GEBIETE DER ELEKTRICITAET WAEHREND DER DEWEY-FEIER IN NEW YORK. (Seite 531.)

Einer der Hauptzüge der Dewey-Feier bildete die Verwendung von elektrischer Beleuchtung für dekorative Zwecke, indem man viele Tausende von Pferdestärken elektrische Energie für diesen Zweck in Anwendung brachte. Auf der Brooklyner Brücke wurden 8000 Lampen von je 16 NK angebracht, um die beiden Wörter „Welcome Dewey" deutlich hervortreten zu lassen. Je fünf Lampen hatte man an einen Stromkreis von 500 Volt in Reihen geschaltet.

AUSZUG AUS DER NEUESTEN LITTERATUR DER ELEKTROTECHNIK. (Seite 535.)

Wochenübersicht der gesammten, in der ganzen Welt erschienenen Litteratur über Elektrotechnik. Die wichtigen Artikel, die in den in englischer, deutscher, französischer und italienischer Sprache publizirten Hauptzeitschriften enthalten und ganz oder zum Theil elektro-technischen Angelegenheiten gewidmet sind, werden im Auszug wiedergegeben; weiterhin auch Auszüge aus den, elektrische Fragen betreffenden, Verhandlungen professioneller Vereine, gelehrter Gesellschaften u. s. w.

ABSATZGEBIETE FUER DIE ELEKTRISCHE INDUSTRIE IM FERNEN OSTEN. (Seiten 522 und 526.)

Ueberblick über die Lage im fernen Osten hinsichtlich des Exportgeschäfts auf dem Gebiete der Elektrizität. Der Verfasser des einen Artikels, Prof. F.

B. Crocker von der Columbia Universität und Mitglied der Crocker-Wheeler Electric Company, ist vor Kurzem von einer Reise um die Welt über Japan, China, die Philippinen und Indien zurückgekehrt und veröffentlicht die Eindrücke betreffs des Handels mit jenen Völkern, insoweit das Gebiet der Elektrizität dabei in Betracht kommt. Nach seinem Dafürhalten stehen diese Länder, was die Verwendung der Elektrizität betrifft, am Vorabend bedeutender Entwicklungen, und zwar hauptsächlich in Bezug auf elektrischen Verkehr und elektrische Energieübertragung von Wasserkräften. Elektrische Beleuchtung sollte, da sie in heissen Klimaten als ganz besonders wünschenswerth erscheint, ebenfalls einer grossen Verbreitung entgegengehen, und gilt dasselbe von Ventilatoren, die durch Elektrizität gtrieben werden. Ein besonderer Nachdruck wird auf die Nothwendigkeit gelegt, sich den Wünschen und Sitten der konservativen Völker des Ostens anzupassen, welche tief eingewurzelte Ideen über Formen, Grössen und selbst Farben von Artikeln, die sie wünschen, haben und deren Grillen, weil sie eben Kunden, nachgegeben werden sollte. Die Art und Weise, in welcher man Waaren verpackt, macht ebenfalls einen grossen Unterschied in deren Verkäuflichkeit. Ein zweiter Artikel über dasselbe Thema stammt aus der Feder des Herrn W. J .Johnston, des früheren Eigenthümers der „Electrical World", welcher seit einem Vierteljahrhundert zur Verbreitung der Elektrizität journalistisch beigetragen. Zwischen den merkantilen Eigenschaften der Japanesen und Chinesen wird eine Parallele gezogen, und fällt dieselbe unbedingt zu Gunsten der Letzteren aus.

TAGESNEUIGKEITEN UND MITTHEILUNGEN. (Seite 533.)

In dieser Abtheilung kommen ausser Tagesneuigkeiten und vermischten Notizen auch die wichtigen Patente der Woche ihrem Hauptinhalte nach zur Sprache. Unter diesen letzteren befindet sich in dieser Nummer eine Beschreibung einer neuen elektrischen Schienenverbindung, ferner die eines Dreiphasen-Wattstundenmessers, einer neuen Glühlichtfaser, dann die eines Verfahrens zum Herstellen von Akkumulatorenbatterie-Platten, einer Polisolirung; weiterhin die Beschreibung eines Prozesses für die Fabrikation von Kompositionsdraht, einer elektromagnetischen Friktionsbremse für mehrphasige Motoren; ferner der zu einer bestimmten Zeit in Aktion tretende Momentausschalter, wie er an Niagara-Stromkreisen benutzt wird; eine neuartige Mehrphasenbewickelung; ein neuer Wechselstrom-Kompensator; Einzelheiten betreffs des Magnetfelds der Niagara Krafterzeugungsmaschinen, und endlich ein neuer Typus eines Wechselstrom-Kollektorrings.

WECHSELSTROM-MASCHINEN FUER DIREKTEN BETRIEB. (Seite 529.)

Ein von Herrn Alton D. Adams verfassten Artikel spricht sich zu Gunsten der Benutzung des Wechselstroms für Fabrikbetrieb aus. Er behauptet, dass Wechselstrom-Maschinen von niedriger Frequenz billiger zu bauen, leichter zu bedienen sind und einen niedrigeren Entwerthungsgrad als Gleichstrom-Maschinen aufweisen. Sodann folgt eine kurze Beschreibung der Wechselstromanlage für die Maschinenwerkstätte der New Yorker Schiffswerke, wo 2000 PS zum Treiben der Maschinerie vertheilt werden sollen. Umformer kommen nicht zur Verwendung, und wird der Strom zu 230 Volt erzeugt und benutzt.

FINANZ UND HANDELSNACHRICHTEN. (Seite 554.)

Diese Abtheilung enthält eine Zusammenstellung der gegenwärtigen Finanz- und Handelsoperationen auf dem Gebiete der Elektrizität, und geben die letzteren eine ausführliche Wochenübersicht des Handels.